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UNIVERSITY OF HERTFORDSHIRE

Faculty of Engineering and Information Science

BACHELOR OF ENGINEERING/SCIENCE DEGREE/DEGREE WITH HONOURS IN MULTIMEDIA TECHNOLOGY & DIGITAL BROADCASTING

Project Report

INTERACTIVE OSCILLOSCOPE TRAINING PACKAGE

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The

Abstract

The report discusses and provides in depth, detailed documentation of the work carried out to create a suitable visual training package to introduce an oscilloscope. The purpose of creating this training was to aid 1st year BEng students at the University of Hertfordshire Hatfield campus. The design and implementation of the package has been based upon the knowledge of current first year students and what is likely to be required by them as they are to be the end user.

The report goes through several procedures that had to be taken into consideration these include; research, investigations, testing and results to create the end result of a user friendly computerised learning tool/package.

This report discusses and illustrates in great detail on how the training package was created from ideas to design to actual implementation, highlighting particular points, problems and drawbacks that occurred.

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Acknowledgement

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CHAPTER 1 1
1.1 Introduction 1
1.2 Project scenario & Authors Background 1
1.3 Project Aim & Objectives 1
1.3.1 Aim 1
1.3.2 Objectives 2
1.4 Methodology 2
1.4.1 Problem Definition 3
1.4.2 Requirements & Analysis 3
1.4.3 System Design 4
1.4.4 Implementing & Testing 4
1.4.5 Integration & System Testing 4
1.4.6 Review & System Maintenance 4
1.5 Report Overview 4
1.5.1 Chapter 1, Introduction 5
1.5.2 Chapter 2, Background Information 5
1.5.3 Chapter 3, System Analysis/Research 5
1.5.4 Chapter 4, Project Plan 5
1.5.5 Chapter 5, System Design Approach 5
1.5.6 Chapter 6, Implementation 5
1.5.7 Chapter 7, Testing 5
1.5.8 Chapter 8, Evaluation/Conclusion/Further Developments 6
CHAPTER 2 7
Background Information 7
2.1 Introduction 7
2.2 Oscilloscope Image 7
2.3 What is an Oscilloscope? 7
2.4 Representation of a Signal 8
2.5 Types of Oscilloscopes 8
2.5.1 Analog Oscilloscope - how does it work? 8
2.5.2 Digital Oscilloscope – how does it work? 8
2.6 Controls 9
2.7 Measurements 9
2.7.1 Amplitude 9
2.7.2 Frequency 9
2.7.3 Wavelength 10
2.7.4 Phase Shift 10
2.7.5 Measuring Voltage 10
2.7.6 Time & Frequency Measurements 11
2.8 Waves 11
2.8.1 Sine Wave 12
2.8.2 Square Wave 12
2.8.3 Triangle Wave 12
2.9 Further Information Gathering 12
2.9.1 Questions 12
CHAPTER 3 14
System Analysis/Research 14
3.1 Questionnaire results & analysis 14
3.1.1 Results & Analysis 14
3.2 Current system analysis 15
3.2.1 Disadvantages of current method/system 15
3.3 Requirements Analysis 15
3.3.1 System Requirements 15

University of Hertfordshire

3.4 Software.....16
3.4.1 Macromedia Flash MX.....16
3.4.2 Adobe Photoshop 7.0.1.....16
CHAPTER 4.....17
Project Plan.....17
4.1 Plan.....17
4.2 Tasks/Stages of work.....17
CHAPTER 5.....19
System Design Approach.....19
5.1 Basic Content of training package.....19
5.1.1 Initial Content.....19
5.1.2 Revised Content.....19
5.2 Content Flow Chart.....21
5.3 Navigation Through Package.....22
5.4 General Page design and Layout.....23
5.5 First idea for page layout.....23
5.6 Backgrounds & Colour scheme.....23
5.7 Development to final design.....24
5.7.1 Problem with layout.....25
5.7.2 Solution to layout.....26
5.8 Flash Intro Design.....26
5.8.1 Final Flash Intro Design.....27
CHAPTER 6.....28
Implementation.....28
6.1 Package implementation.....28
6.2 Home page implementation.....28
6.2.1 How the animation worked originally.....29
6.2.2 Explanation of the Action Scripting.....29
6.2.3 Problems.....30
6.2.4 Solving problems.....30
6.3 Navigation Implementation.....31
6.3.1 Problem.....32
6.4 'What is an oscilloscope' page implementation.....32
6.4.1 Problem.....32
6.4.2 Problem Solution.....32
6.5 Controls page implementation.....33
6.5.1 Controls Profile implementation.....33
6.5.2 Problems.....33
6.5.2 Problem solved.....34
6.6 Learning the controls.....34
6.7 Displays.....34
6.7 Oscilloscope pictures.....35
6.8 The Test.....36
CHAPTER 7.....37
Testing.....37
7.1 Method of testing.....37
7.2 Viewing results table.....37
7.3 Feedback.....38
CHAPTER 8.....39
Evaluation/Conclusion/Further Developments.....39
8.1 Evaluation.....39
8.2 Time Management.....40
8.3 Conclusion.....40
8.4 Further developments.....40
Reference.....41

University of Hertfordshire

Bibliography 42
Appendix Content 43
Appendix A 44
Appendix B 46
Appendix C 49
Appendix D 53
Appendix E 59
Appendix F 61

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Content of Figures

Figure 1 Waterfall Diagram 3
Figure 2: Tektronix 2225 Oscilloscope [3] 7
Figure 3: Diagram of the axes [1] 8
Figure 4: Indicates where the amplitude is on a waveform 9
Figure 5: Indicates where wavelength is measured [4] 10
Figure 6: Diagram showing different phase shifts [4] 10
Figure 7: Voltage of peak-to-peak & Voltage of one peak [1] 11
Figure 8: Different waves[2] 11
Figure 9: Showing design flow of training package 21
Figure 10: Showing navigation of training package 22
Figure 11: First idea for navigation design 23
Figure 12: Colour scheme & background design1 23
Figure 13: Colour scheme & background design2 24
Figure 14: Fill transform tool in Macromedia Flash MX 24
Figure 15: Adobe Photoshop image of proposed layout 25
Figure 16: Proposed layout with images 25
Figure 17: Final layout design 26
Figure 18: First stage of Flash Intro design 26
Figure 19: Second stage of Flash Intro design 27
Figure 20: Third stage of Flash Intro 27
Figure 21: Final Flash Intro design 28
Figure 22: Time line of oscilloscope puzzle animation 28
Figure 23: Rollover buttons and home intro information 29
Figure 24: Action scripting for the first scope button 29
Figure 25: Timeline of scope button movie 31
Figure 26: Navigation bar before & after 31
Figure 27: First implemented animation for controls 33
Figure 28: Change of timeline 34
Figure 29: Display page 35
Figure 30: First and final design of photo background using Adobe Photoshop 35
Figure 31: Design of button for photo slide 35

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CHAPTER 1

1.1 Introduction

Multimedia wasn't widely used in the past but in the last 10 years, this technology has become apart of everyday life. Breaking it down it combines forms of images, text, sound and interactivity to present information in the senses of visually seeing and hearing from what you would read for example from a book. Generating ideas and information as visual content to create ease of use and a new way of learning providing greater knowledge.

The aim is to use the general aspects described above and create a visually suitable and user-friendly training package.

1.2 Project scenario & Authors Background

Engineering students (BEng) and Multimedia students (BSc) at the University of Hertfordshire will sometime during their degree be using an oscilloscope in their laboratory sessions. Often new students would need help in using such an instrument especially if they are first time users. These technical instruments are often used in laboratories D405/D411/D421, where lab students conduct investigations and experiments using this particular machine with other instruments and devices.

At present, the type of information used to present the instructions on how to use the oscilloscope is a laminated sheet showing the initial setting of various controls, on the reverse there is written information about the controls and there settings. To first time users of the scope this might be a bit daunting to them as it is rather cluttered and visually boring. They may not be taking in as much information as they should be and might be a little confusing.

There is room for improvement on this particular area, for students to get to grips with handling the do's and don'ts of the scope and the gathering of further information for students to understand what they are dealing with.

1.3 Project Aim & Objectives

1.3.1 Aim

The aim of this project is to create and produce an interactive, audio-visual multimedia-training package to introduce and aid first time users' e.g. new students in understanding how to use an oscilloscope. A computer based training package that will enable

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unsupervised or of minimum supervision, instructing the user in operating the basic functions available in an oscilloscope. The trainee will be working alongside the PC and will be instructed to perform any operations before proceeding to the next stage.

1.3.2 Objectives

The objectives of the project are as follows: -

- Developing a successful multimedia package, providing the user with useful learning material, that will enable them to learn and remember making the package successful.

- Consists of the basic functions available on an oscilloscope e.g. on screen images of the different parts of the machine

- Use of interactivity between the user and package, user able to interact with the package and respond to the interaction

- Development from 2D to 3D images, good use of images and developing a creative and imaginative package design

- Develop an effective and educational training package, providing clear step-by-step and easy to follow instructions to user. Implementing useful and detailed content but so much so that the learning experience is not time consuming and user is able to refer back to at their own convenience

- Ability to download sections of the package and print out any information as required by user

- Adequately demonstrate the fundamental requirements for operating an oscilloscope

1.4 Methodology

Establishing a methodology is very useful as it helps to prevent faults when developing the system, therefore resulting in fewer errors.

Waterfall also known as the cascade model has been is the chosen methodology for this particular task. It is the most commonly used method when creating a system from scratch.

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An important feature of the waterfall method is that each stage of the diagram must be completed before moving on to the next stage. This development life cycle of the system is used to help plan and guide development and progression of the project effectively.

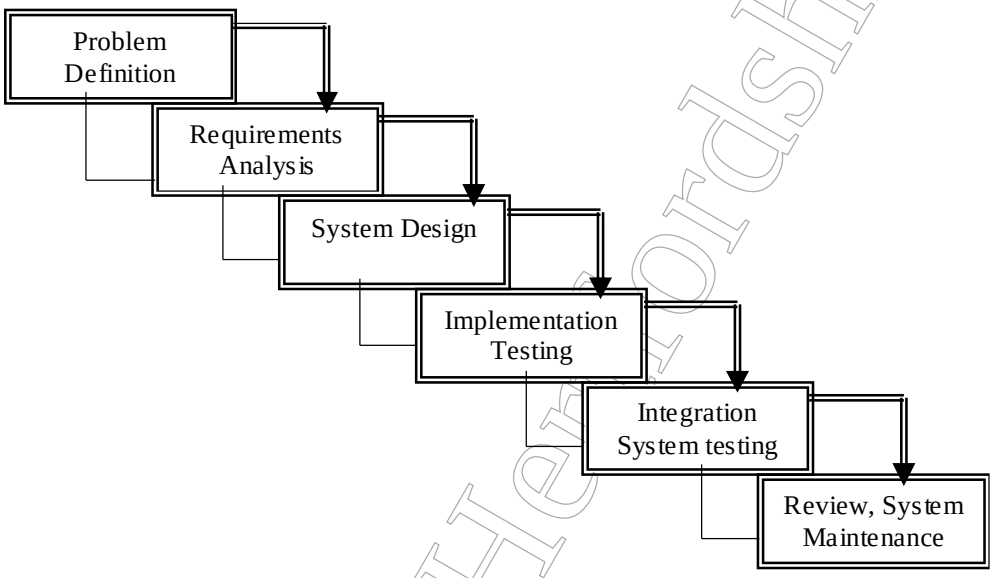

Figure 1 Waterfall Diagram

The following concludes a brief breakdown and understanding of the waterfall diagram and reasons for its use:

1.4.1 Problem Definition

Clearly identify the current problem or the task that has been set. This can be done either by observations, questionnaires, interviews or all three if need be.

Also taking into account further research into the topic surrounding the problem put forward trying to gather as much information as possible to create a greater understanding. Without a clear overview or background knowledge of the problem it would be rather difficult for the developer to achieve the requirements.

1.4.2 Requirements & Analysis

This stage discusses the user requirements. Certain requirements or specifications that are required for the system and been put forward by the user and/or client need to be looked at in detail e.g. looking back at the objectives of the system and any additional requirements obtained by the questionnaires.

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1.4.3 System Design

Designing the system, or in this case a suitable training package, is a major part in development and creating a successful package. Storyboarding, brainstorming ideas is a necessity in aiding the developer when planning and developing the end package. A break down of the system could be of some help such as user interface, layout, some form of navigation etc.

1.4.4 Implementing & Testing

Working closely with system design stage in the waterfall method. It is a process by which developer tests the system during the designing and implementing stage, also a form of trial and error. Once the system/package is fully implemented the package as a whole is tested, an outside party does this testing normally. This helps to check for errors and faults that are not always notice or have been missed by the developer. Also generating some form of feed back of any further improvements that may be add before final production goes ahead.

1.4.5 Integration & System Testing

This involves working closely with implementation and testing. Making sure all software that is used to create the package is available to the end user. Using additional software/programs that the client does not have could arise in problems with costing, unless there has been a budget set that is available to use.

1.4.6 Review & System Maintenance

The final stage of the waterfall is carried out once the system is completed and up and running in the live environment it has been created for. The reviewing method needs to be devised in order to keep check of the system and check that it is meeting the requirements that were set at the beginning of the project. This also helps to identify the weaknesses or strengths of the system that could lead to possible improvements.

1.5 Report Overview

The report provides in depth, detailed documentation of the work carried out to create the visual training package to introduce an oscilloscope. The various chapters highlight the stages of work going into detail how the project was carried out and how the developer handled it. Giving insight into the research, results, design and problems that came about. Reading this report should help people who are not as familiar with this particular area of technology, understand and follow the work through of this project.

There are 8 chapters to this report:

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1.5.1 Chapter 1, Introduction

This chapter includes project scenario, author's background, aims and objectives and methodology, specific to this project.

1.5.2 Chapter 2, Background Information

This section highlights the background knowledge and information needed to create a successful training package. It looks into the particular oscilloscopes that are used in the university laboratories (Tektronix 2225 Oscilloscope (50 MHz)). Looking into much detail about the scope, the controls, its settings, what it's used for and how it works and any other additional information that would be suitable training purposes. Reasons for obtaining a questionnaire.

1.5.3 Chapter 3, System Analysis/Research

This looks into the results gathered from questionnaires. Questionnaires used to obtain vital information and findings of what the end user, the students would want out of such a training package. Analysing the sort of system that is required and if and how it could be obtained by the developer. To help with the system analysis, research is carried out to obtain the requirements needed. Looking into the type of software/packages to be used and using one or many of these packages how they could be used to the developers advantage of creating a successful package.

1.5.4 Chapter 4, Project Plan

The project plan is broken down into sections. Describing an overview of how the project is carried out. A stage-by-stage development of work. The task and stages are broken down into duration of weeks using the method of a gaunt chart.

1.5.5 Chapter 5, System Design Approach

This chapter looks into major detail of the system design, in this case the design, style and layout of the training package to be. This looks into the creation of the actual package, the steps taken before actually implementing the design. Storyboarding ideas.

1.5.6 Chapter 6, Implementation

The chapter discusses the actual execution of the package, from taking ideas and design from paper and actually implementing it on the screen for visual content. This section also encounters problems and how and if they were solved.

1.5.7 Chapter 7, Testing

When the package is complete testing has to take place. Testing the package as a whole by end users. This is done to encounter any problems that may have been over looked by the developer.

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1.5.8 Chapter 8, Evaluation/Conclusion/Further Developments

The chapter discusses the original aims and objectives of the project, whether or not the requirements have been meet successfully. Evaluating the project as a whole, giving an overall conclusion on the work carried out. It also looks at project/time management, alternative methods, further developments and problems.

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CHAPTER 2
Background Information

2.1 Introduction

The final package will intend to be used by the first year engineering and multimedia students at the University. The package will aim to be used at the student's induction week of the course. Having this in mind students who are not familiar with this machine or only have a little knowledge of this instrument, need to know all of what is available by the machine and the purpose of using such an instrument.

"Nature moves in the form of a sine wave, be it an ocean wave, earth-quake, sonic boom, explosion, sound through air, or the natural frequency of a body in motion"[1]. Using sensors these waves can be converted into electrical signals that can be observed and studied using an oscilloscope. They are used so scientists, engineers, technicians and educators are able to see events that change over time use.

2.2 Oscilloscope Image

This picture is a very close match to the oscilloscopes in the laboratories.

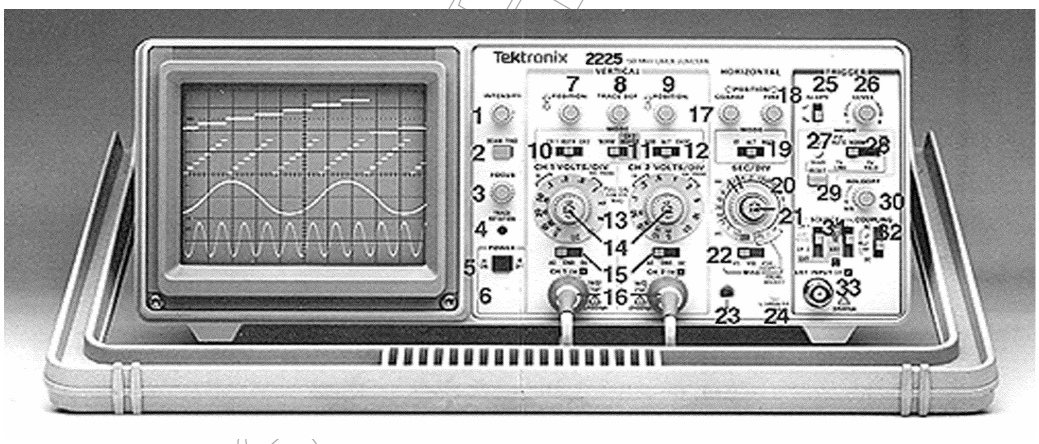

Figure 2: Tektronix 2225 Oscilloscope [3]

2.3 What is an Oscilloscope?

The oscilloscope is a graph-displaying device; it draws the graph of an electrical signal and provides a way of literarily seeing what is happening in a circuit. The graph shows how signals change over time. The vertical axis (Y) represents voltage and the horizontal axis (X) represents time.

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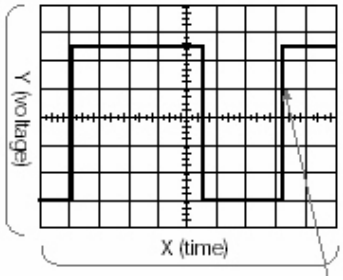

Figure 3: Diagram of the axes [1]

2.4 Representation of a Signal

A graph of a signal can tell you many things about the signal begin transmitted:

- The time and voltage values of a signal
- Frequency of an oscillating signal
- 'Moving parts' of a circuit represented by the signal
- Frequency with which a particular portion of the signal is occurring relative to other portions
- Whether or not a malfunctioning component is distorting the signal
- How much of a signal is direct current (DC) or alternating current (AC)
- How much of the signal is noise and whether the noise is changing with time

2.5 Types of Oscilloscopes

Electronic devices can be classified into 2 categories analog and digital. Analog devices work with continuously variable signals and digital devices work with discrete binary numbers that represent voltage samples. For applications either an analog or digital scope would do, however each type has unique characteristics that can make it more or less suitable for the specific application.

2.5.1 Analog Oscilloscope - how does it work?

It works by applying the measured signal voltage directly to the vertical axis of an electronic beam that moves from left to right across the oscilloscope screen, using a cathode-ray-tube. The backside of the screen is treated with luminous phosphor that glows wherever the electron beam hits it. The signal voltage deflects the beam up and down proportionally as it moves horizontally across the display, tracing the waveform on the screen. The more frequently the beam hits the brighter the glow.

2.5.2 Digital Oscilloscope – how does it work?

A digital scope uses an analog-to-digital converter (ADC) to convert the measured voltage into digital information. It acquires the waveform as a series of samples and stores these samples; it accumulates enough samples to describe a waveform. The digital scope then re-assembles the waveform for display on the screen.

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2.6 Controls

The scope has 33 controls in total. Each control on the oscilloscope operates a different function to one another. These controls are slip into sections as follows: Vertical controls, Horizontal controls and Trigger controls.

When starting up the oscilloscope the controls need to be set to a particular setting before work can proceed. If this is not done then the results you would obtain will probable be of no use, as results would be inaccurate.

Refer to appendix C, for the table of controls the names, setting and recommended use.

2.7 Measurements

The two basic measurements you can make are voltage and time measurements. Most if not all measurements are base on these fundamental techniques. Measurements are taken visually using the oscilloscope screen.

2.7.1 Amplitude

This is the height of the wave. The amplitude is the maximum positive displacement from the undisturbed position of the medium to the top of a crest**.** Divisions on the scope measure this; each square on the scope is equal to 1 division.

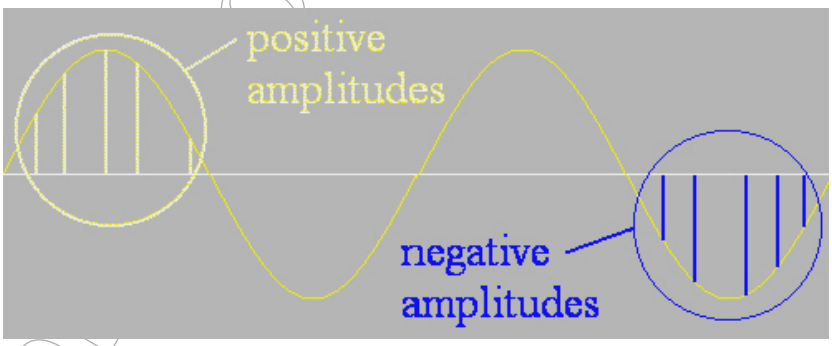

Figure 4: Indicates where the amplitude is on a waveform

2.7.2 Frequency

Frequency refers to how many waves made per interval i.e. the number of complete cycles per second in alternating current direction. The standard unit of frequency is the hertz, abbreviated Hz. If a current completes one cycle per second, then the frequency is 1 Hz; 60 cycles per second equals 60 Hz.

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2.7.3 Wavelength

Wavelength of a wave is the distance between any two adjacent corresponding locations on the wave train. This distance is usually measured in one of three ways: crest to next crest, trough to next trough, or from the start of a wave cycle to the next starting point.

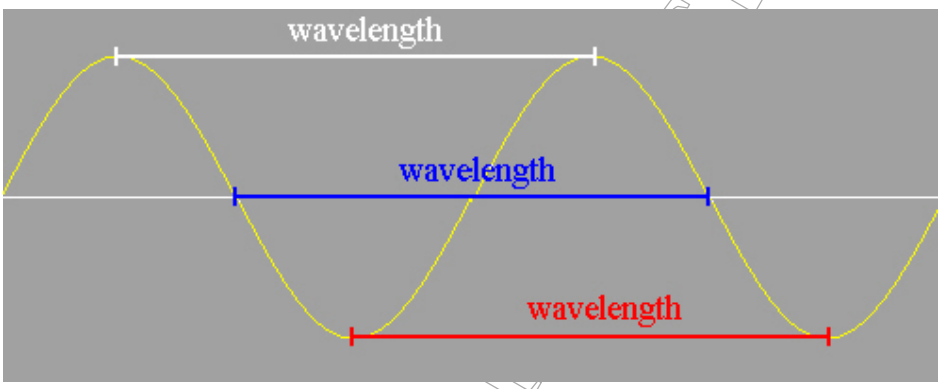

Figure 5: Indicates where wavelength is measured [4]

2.7.4 Phase Shift

The phase shift describes how far to the left or right the wave slides.

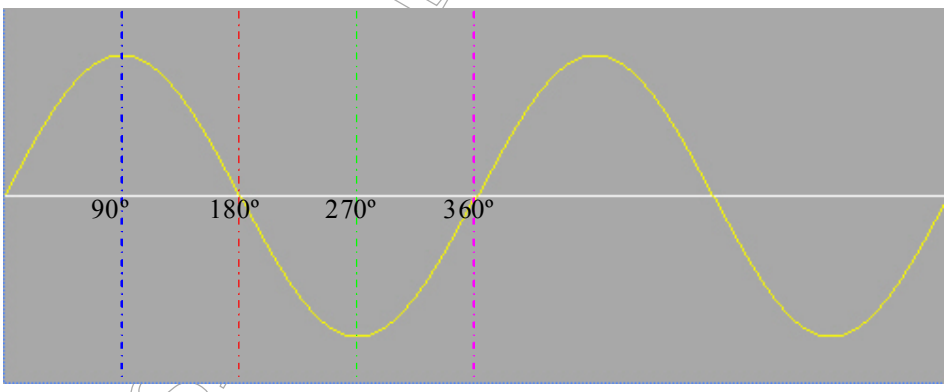

Figure 6: Diagram showing different phase shifts [4]

2.7.5 Measuring Voltage

Voltage is the amount of electric potential, expressed in volts, between two points in a circuit. Voltage can be measured from peak-to-peak from the maximum point of a signal to its minimum point. The oscilloscope is mainly a voltage-measuring device, but other quantities can also be calculated using the scope. For example, Ohm's law states that voltage between two points in a circuit equals the current times the resistance. From any of these quantities you can calculate the third using the following formula: [1]

Voltage = Current x Resistance

Current = Voltage/Resistance

Resistance = Voltage/Current

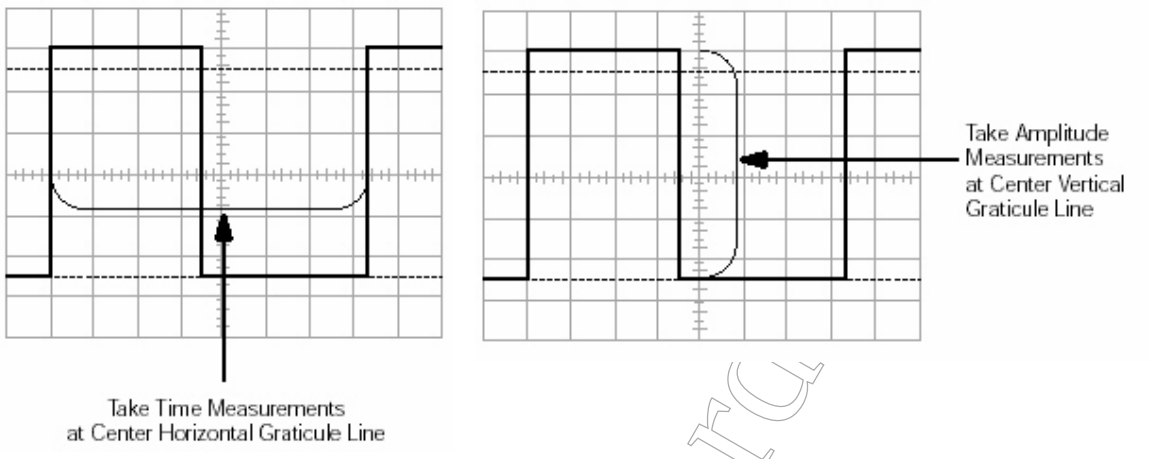

Figure 7: Voltage of peak-to-peak & Voltage of one peak [1]

Method of taking voltage measurements is by counting the number of divisions a waveform spans on the oscilloscope vertical scale.

2.7.6 Time & Frequency Measurements

Using the horizontal scale on the screen of the scope does time measurement. This includes measuring the period pulse. Frequency is the reciprocal of the period.

2.8 Waves

Wave meaning the generic term for a pattern that repeats over time. Waves are a part of everyday life from brain waves, ocean waves to electronic waves these are all repetitive patterns moving in continuous motion. A cycle of a wave is where it repeats itself on the waveform, which is a repetition of one cycle. The most common waveform is the sine wave (sinusoidal wave). Other waveforms include square wave, saw tooth, the ramp and the triangular wave.

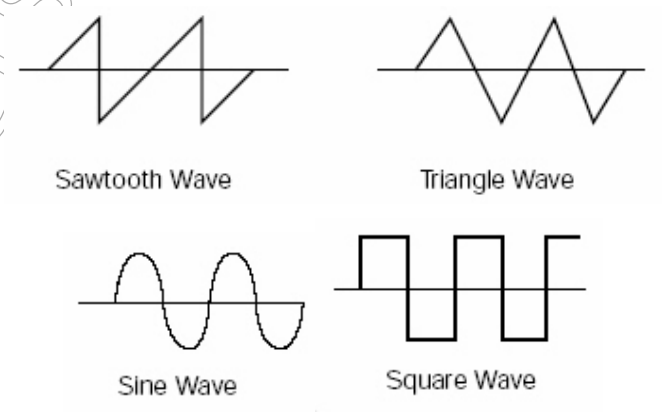

Figure 8: Different waves[2]

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The shape of a waveform reveals a lot of information about its signal. If there is a change in the height of the wave, this indicates that there has been a changed in voltage. Any time a flat horizontal line appears this indicates there has been no change for that length of time.

2.8.1 Sine Wave

Sine wave has harmonious mathematical properties. For example the voltage in wall outlets varies as a sine wave [2] (sinusoidal waveform). A waveform, which oscillates periodically with the amplitude of points on the waveform proportional to the sine of the phase angle of the point [5].

A periodic oscillation. The fundamental waveform from which other waveforms may be generated by combinations of various group of harmonics. The voltage and current waveforms produced from the power company generators (alternators) are basic sine waves [6].

2.8.2 Square Wave

Square wave is voltage that turns on and off or goes from high to low at regular intervals [2]. It's a wave for testing amplifiers; amplifiers of good quality increase amplitude of the square wave with very little distortion.

2.8.3 Triangle Wave

A triangle waveform is one with alternating positive- and negative-sloped ramps. Its frequency spectrum includes all of the odd harmonics. It results from circuits designed to control linear voltages.

2.9 Further Information Gathering

Gathering further information and creating a backbone for the project further investigation had to take place. Creating this training package, user involvement is rather important. The purpose of this project was to create a suitable out come for the end users who are students. A questionnaire was design for this particular purpose to help identify what the potential users require from such a system. Certain types of

questions were asked to find about the student and how familiar they are with using an oscilloscope, if they have used one before and how helpful was the handout manual which is given to them.

2.9.1 Questions

The questions that were asked were based on the students using the equipment in the induction week at the university.

- Have you used an oscilloscope before?

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This was to identify how many students have or have not used an oscilloscope before. This would indicate how much in depth information content in the package would need to be. The likely hood of this would be that many were beginners and so basic and in depth but not to over whelming content would need to be provided in the training package.

- How useful are the manuals that are provided in the laboratories?
- Was the manual straightforward to follow?

This was to indicate how useful the manuals were that are currently provided to them. This would also help to analysis the current system.

- What sort of manual would you prefer to use… printed handout copy, on screen/on line manual, or both?

This would indicate the sort of help guidance the user would prefer when using the scope.

- Have you used an on-line training package before?
- If yes how useful has it been to your learning?
- What sort of online training tutorials sites have you used?

This would give an idea of how many students have used a training package before and are familiar with this sort of teaching/learning concept. Also indicating the usefulness of a training package. Finding out about the sites they have used already would help in researching and creating knowledge of how these sort of sites are layout and help to encourage the development of this package.

- Do you prefer… information text guide, an interactive animated guide or bit of both?

What the user would like to see on the package, how they would like the information to be set out.

- Would you have found such a training package useful during indication week?

Indicating how useful this package would be to them and encourage a better learning outcome.

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CHAPTER 3
System Analysis/Research

3.1 Questionnaire results & analysis

A questionnaire was handed out to individual students of a first year engineering class during one of their lab sessions. They were asked to fill out the questionnaire as though they were in there first week of induction at university.

To see the questions and completed questionnaires please refer to appendix A.

3.1.1 Results & Analysis

The results from the questionnaire that were considered the most important are shown below:

Question 1 had been asked to see how many of the students had used an oscilloscope before, the results show that over half the class had never used an oscilloscope before. This indicates that most of these students and likely students in years to come have never used an oscilloscope before therefore having little or no knowledge of an oscilloscope a training package would be of great use to these students as a sort of beginners guide.

Question 2 was asked to find out how useful the manuals in labs were. Results show that about 11 out of 25 students found the manual to be of average use giving it a rating of 3 from a scale of 1 to 5, where 1 = no use and 5 = very useful. 6 out 0f 25 students found it quite useful.
Although the students found the manual of average use there is still room for improvement.

Question 4 results show that 11 out 25 students would like to use both on-screen manual and handouts and another 11 out of 25 students would still find using handout manuals useful.

The results of question 5 indicate not many students have used an on-line training package before. This shows that when designing and developing the training package careful consideration needs to be taken into account in creating a user-friendly package that is very clear and easy to use.

The results to question 8 reveal that the potential end user would like to see a bit of both textual information as well as interactive animated guide. This shows that users like to

interact while they are working. Seeing visual content and being able to interactive with images makes the user more interested in what they are doing.

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3.2 Current system analysis

The current form of teaching students how to use the controls on the oscilloscope is done by using a typed up information sheet. This sheet is presented with an image of the scope and its initial settings for the controls when it is first used. On the reverse side of this sheet there is written information informing the student of the name of the controls, usage of the controls and reasons why they need to be set at particular settings.

Although this method has been used over the years and has been averagely successful, tutors would like to see students getting more involved and gaining a bit more understanding and knowledge about oscilloscope, their function and purpose of use in labs.

3.2.1 Disadvantages of current method/system

- There is a lot of information on one single sheet. It is rather cluttered with written content. Thus putting the user off reading the information sheet and finding it difficult to follow, missing vital information or instructions
- There is no further information such as waves and calculations, which is considered important when learning how to use an oscilloscope.
- Not slip up in easy to follow sections can be rather confusing when reading
- Not very interesting to read

As time moves on so do the traditional ways of working, introducing new and improved methods of working and learning, keeping up with technology taking what multimedia has to offer.

3.3 Requirements Analysis

As the end user has already been identified and what the specific need for the system is, system requirements need to be set as general guidelines for the developer to follow. Following these requirements closely would help create a successful package having the user in mind and what would be best suited to them.

3.3.1 System Requirements

- Computer based training package
- User friendly
- Easy to navigate through the package
- Break down of the relevant information
- Easy to follow instructions
- Good use of images

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- Use of interactivity
- Interesting content
- Clear use of information
- Eye catching lay out of package
- Use of audio

3.4 Software

To create this training package the main software that was used to build the package was Macromedia Flash MX. Microsoft Word was used to create paragraph textual information and Adobe Photoshop was used to help create images for examples buttons and adjust and improve photographic images.

3.4.1 Macromedia Flash MX

Flash was used as the bases of design for the whole package. Macromedia flash can also be used to create fully functional websites or can be just used to create animations. The reason for using flash software to create the package was because it has great features for creating interactive and animated sites or packages. The presentation of work done in flash is of high quality, allows user to create smooth graphics while maintaining a low file size, which is important as these files would have a faster download time. Using flash the user is able to create animated movie clips using a timeline. Method of using Action Script language which is available to use in flash enables to create user interactivity in the application. To view flash files the user must have a flash plug-in to view them otherwise it will not be seen on their computers.

3.4.2 Adobe Photoshop 7.0.1

This software was used because it allows you to edit images. The software also allows the user to manipulate photos so that they appear clearer. The software has many features to offer such as, standard paint and drawing tools so you're able to draw good graphics. Many layer styles that allow special and instant effects. Special effect filters to jazz up graphics.

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CHAPTER 4
Project Plan

4.1 Plan

Gathering background information, research, establishing the requirements for the proposed system and working with the aim and objectives, a suitable project and development plan needs to be brought into action.

Managing time is an important factor when starting up a new project. Using time wisely and effectively will lead to successful completion of the project. Arranging time and dividing the project tasks into sections will help to generate a manageable timeline i.e. Gantt chart. If targets and deadlines are not meet accordingly to the dates set then this would cause set backs, delays and working errors.

4.2 Tasks/Stages of work

A general plan of work had been set out see below. To see a detailed project plan and dates please refer to appendix E. Gantt chart (a) shows the initial chart and Gantt chart (b) shows the revised chart.

Research and ideas. This would take a fair amount of time. Gather as much information and background knowledge. Developing first ideas. Although the bulk of the research would be done at the start of the project there may be at times in the project where looking back at research and searching more information will be needed.

Developing ideas content gathering. General ideas for the package layout would be set at this period in time in the project timeline. This would also included content gathering. The content and information that is most likely to be included in the package e.g. images of the scope; break down of the images using adobe Photoshop, written content that needs to be in the package.

Design and implementation. This part of the project is the most time consuming and time needs to be planned accordingly. Good time management equals successful outcome. The steps that were follow:

- Story boarding ideas and design. A record of development of work in progress is kept in a logbook, which is used to refer during the weeks of development of the training package.
- Implementation of design. This includes on-screen or visual development of work. Creating the pages for the package, layout, navigation colour scheme etc. Creating animations for the package is very time consuming and therefore considerable time is needed for this part of the project.

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Testing. Testing is carried out in accordance with implementation as well as a full testing plan at the end of development of the system. Considerable needs to be taken out for this in order for it to be done properly.

Evaluation & conclusion. This part in the project timeline is where the project is evaluated and concluded. The overall project and development are evaluated and a conclusion is made. This is done right towards the end where the report is written up this would have been started about 4 weeks before deadline.

Poster presentation. This is due a week later after the report is handed in. This includes a poster of the progress of work carried out over the academic year, which due to be presented in the second week of May/2004.

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CHAPTER 5
System Design Approach

This chapter show the design ideas for the proposed system. Using the user requirements and objectives that are required for the system, generating a general plan for implementation.

5.1 Basic Content of training package

This shows the basic content of information, how it was initially and the revised content to be included in the package:

5.1.1 Initial Content

- Home Page
- What an oscilloscope is
- Controls
- About the controls
- Displays

This was at the beginning of the project. The client had described that the very basics of the oscilloscope was required from the package not too much information was needed. But over the weeks of development it had been decided that more information was required from the training package to make a successful learning package.

5.1.2 Revised Content

- *Home Page*

General introduction to the training package. Showing the user what the package is about.

- *What is an oscilloscope*

Information about what the oscilloscope is and what it does.

- *Controls*

Information containing the controls, the names of the controls, function of the controls and recommended use.

- *Learning the controls*

This information for the page indicates on how to use the controls whenever you first start using the oscilloscope. Explaining the initial settings of the controls and why the they are set in this way.

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- *Displays*

There a 4 main display controls sections; Display controls, vertical controls, horizontal controls and trigger controls. This information will help to describe what they are and mean.

- *Photographs*

This page will hold images of the oscilloscope they see in the laboratories.

- *Test*

A test incorporated in the training package will help to test the users knowledge and see how much they have learnt from the package.

- *Information on waves*

This includes information on the oscilloscope output. Information about different waveform and information about what is displayed on the screen of the scope. Generating background knowledge to the user and allowing the user to understanding the meaning and purpose of a scope.

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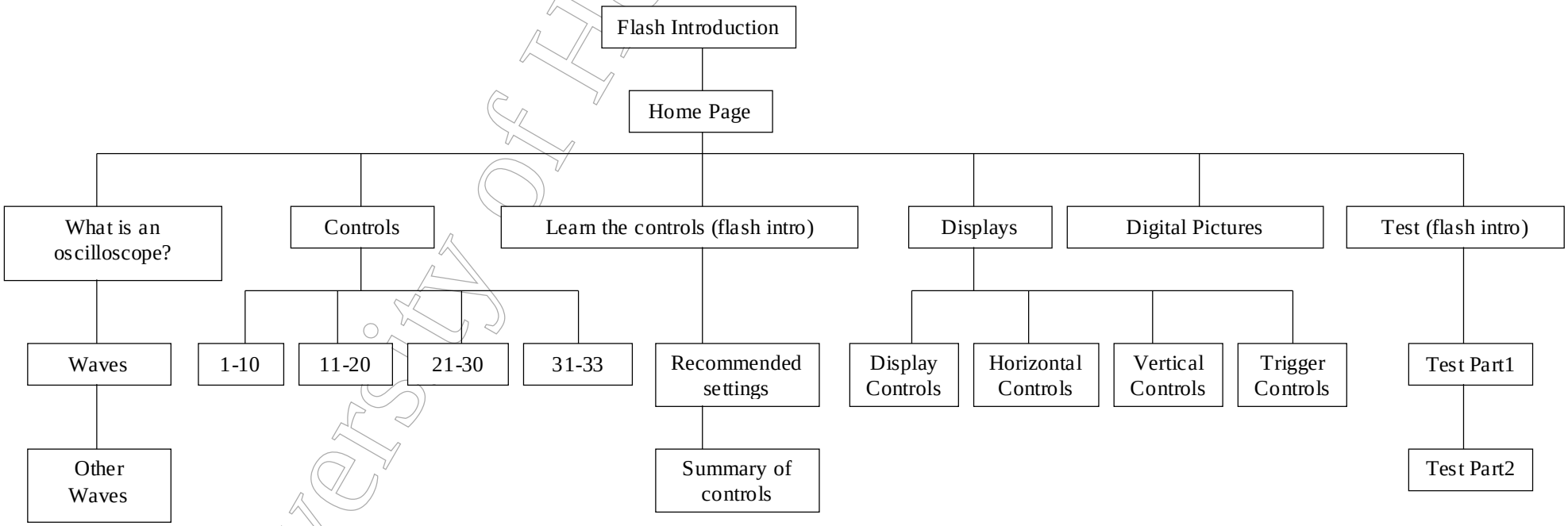
5.2 Content Flow Chart

Figure 9: Showing design flow of training package



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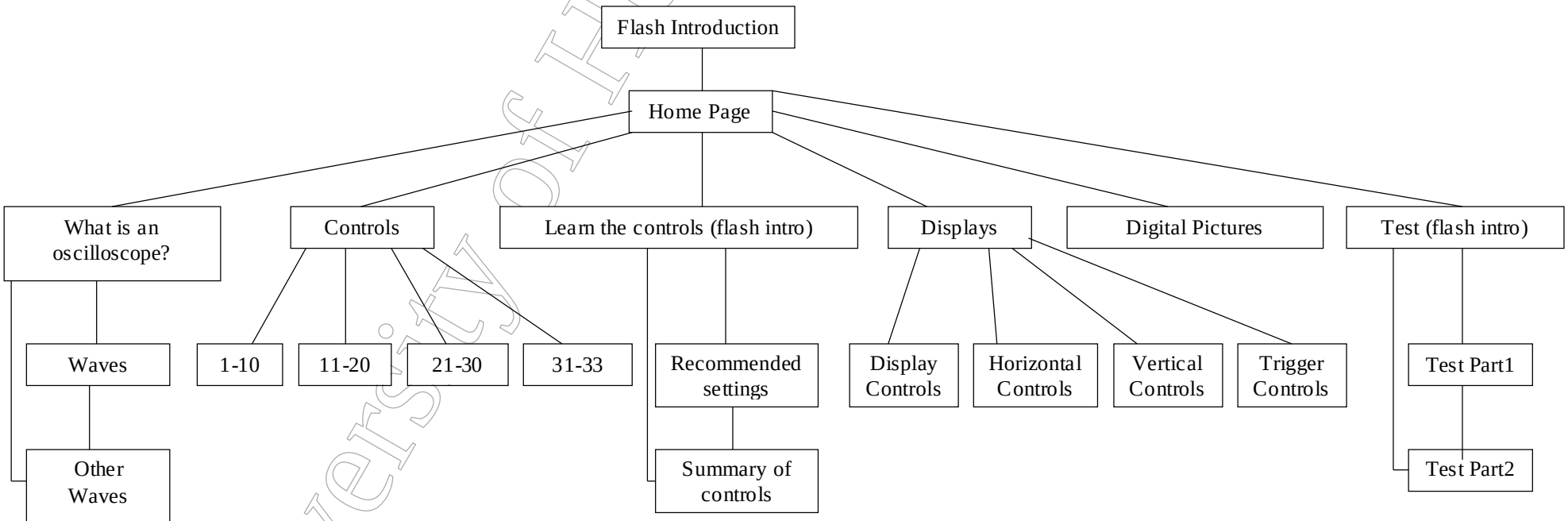
5.3 Navigation Through Package

Figure 10: Showing navigation of training package



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5.4 General Page design and Layout

This section shows the general page design and layout. The package design was based up on the look of a website to present the package to have a professional look and feel to it. All the pages of the package will have the same layout reason being to illustrate consistency throughout the package and therefore creating no confusion to the user.

Several design ideas using sketches were created and logged into a logbook, improving each step of development and coming to a conclusion on which design is best suited to the package.

5.5 First idea for page layout

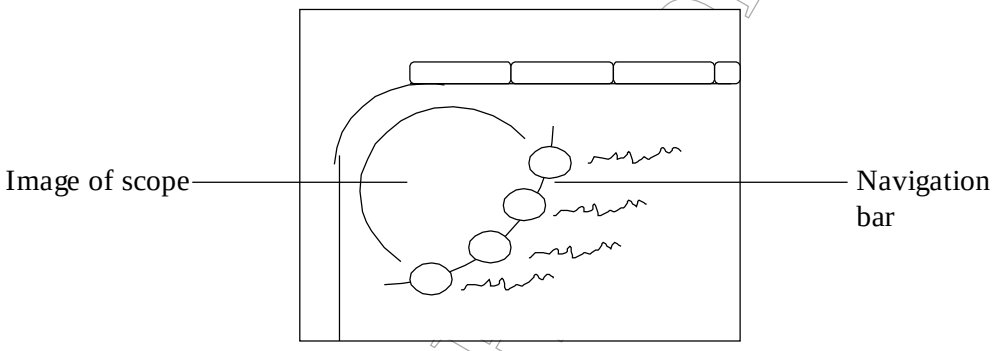

Figure 11: First idea for navigation design

This was the very first idea for a navigation method. This idea was not well suited to the package. It does not use the space provided very well.

5.6 Backgrounds & Colour scheme

These are the colour schemes ideas that had been designed and a basic background design for the package. Both figures 12 and 13 were created using Flash MX.

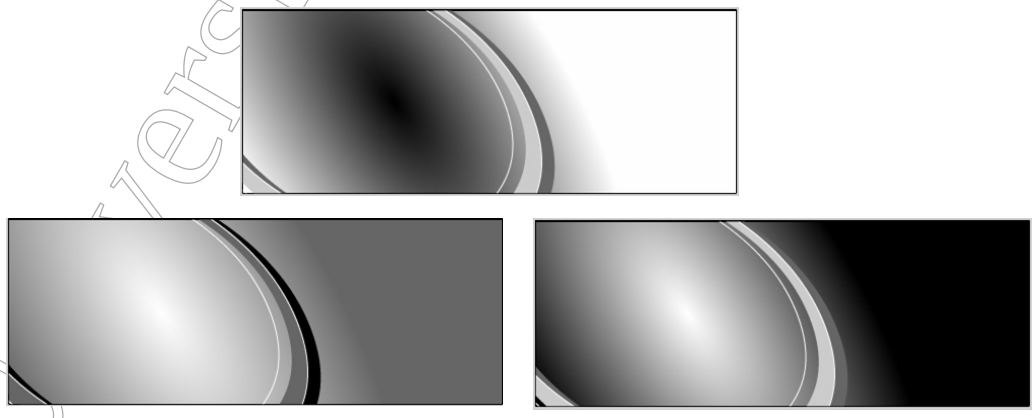

Figure 12: Colour scheme & background design1

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Figure 12 shows a colour scheme that is very basic but at the same time it is very dual. It does not seem visually appealing they do not bring out much enthusiasm. These colours are not suitable for the package being designed, its very black and white making the package look and feel black and white in other words boring. One of the requirements is to make the user feel interested by what they see something that is striking and bold. Figure 13 below shows development of colour design.

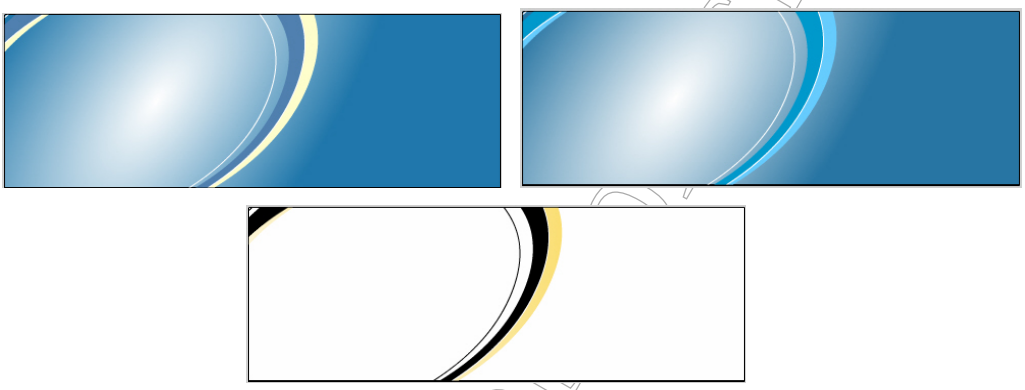

Figure 13: Colour scheme & background design2

The colour combination in figure 13 is more of the look, which is intended for the package. They are not too bright or overpowering but still have certain professionalism about them. The first two images in figure 13 bring out a certain character due to the colours used. A particular tool in Flash MX was used to create the spot light effect. The colours pale yellow and white are also used because they are colours that stand out well with the colour blue. The colours complement with each other and do not clash as for example how yellow would clash with white.

Figure 14: Fill transform tool in Macromedia Flash MX

5.7 Development to final design

There had been several design ideas for the layout of the package and navigation method. It had been concluded that the main colours that would be used and constant throughout the package would be the colours which are shown in the first image of figure 13 above; pale blue, pale yellow and white. Reasons for using these particular colours, they complement one another very well. The colour blue is referred to as 'the working colour' it has psychological meaning behind it were it's a colour which makes

people work and learn making them active and interested, and in this case it is ideal. The colour blue is widely used in environments such as healthcare (hospitals), in education such as schools and universities and different work forces such as the police and the royal navy.

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Figure 16 show the proposed layout with integrating images into the background using Adobe Photoshop to create the image. Figure 15 shows the layout without the image integration. The reason for choosing this sort of design rather then the one shown in figures 12&13 was to create an abstract design effect. Using lines rather than the oval effect suits the topic of the package as the idea of using line reflect the object being described. This design also reflects a better position for a navigation bar.

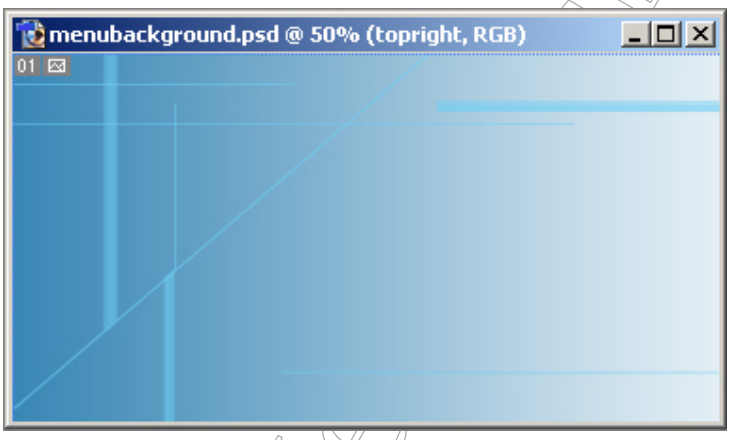

Figure 15: Adobe Photoshop image of proposed layout

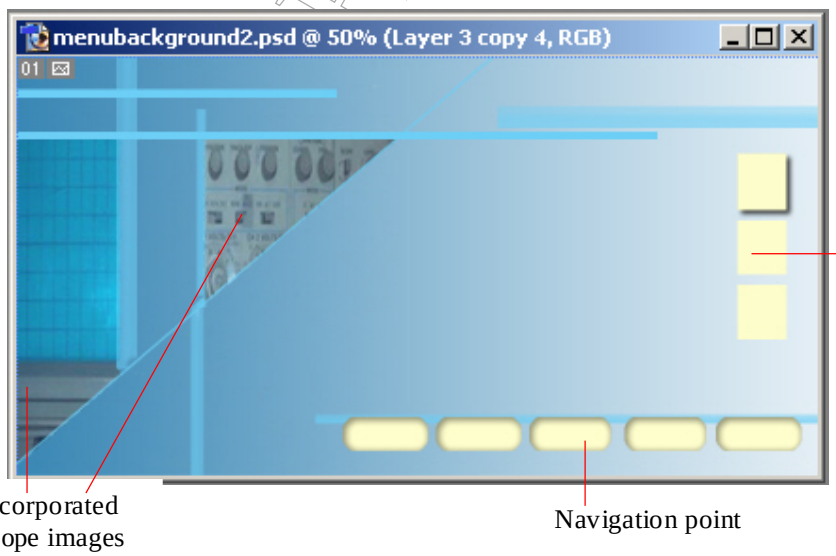

Figure 16: Proposed layout with images

5.7.1 Problem with layout

Although figure 16, design of pages was quite favoured, it did not seem to be practical for the package. It did not seem to quite take the likeness of the sketched idea. The images were very difficult to work with and the images that were being used did not seem to be the ideal images to use. The images that were used were digital photos taken of the oscilloscope in lab D421. They were of poor quality pixel resolution. When trying to enlarge the image the picture would distort.

5.7.2 Solution to layout

After careful consideration and further design development the final layout was created in Flash MX as shown in figure 17. It was implemented using a number of layers and on each separate layer shape, text or buttons were added. The final design is much simpler but at the same time effective. The logo is constant throughout the package. It is bold and visible on the home page and then it is faded out but is still visible on rest of the pages. A simple navigation bar is added to the bottom of the page, it is easily noticeable and accessible.

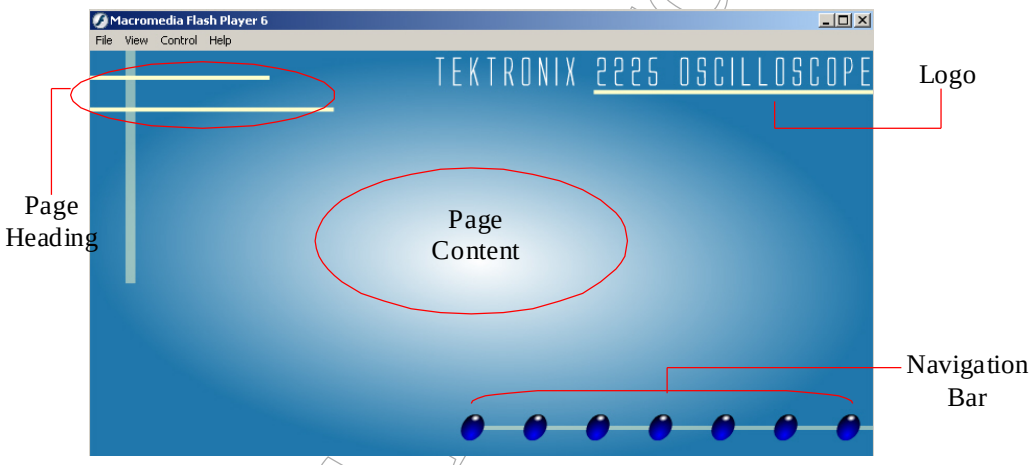

Figure 17: Final layout design

5.8 Flash Intro Design

A flash introduction is what the user first sees when they open up the package. This went through many design stages too. Figure 18 shows the first stage of design. This was created in Flash MX. This design incorporated using a typewriter effect where each letter would appear one after the other as though someone was using a typewriter. The background again was created using the fill transform tool in Flash. With this tool you're able to manipulate the fill background colour. That is how the indented white bright looking egg shape was created.

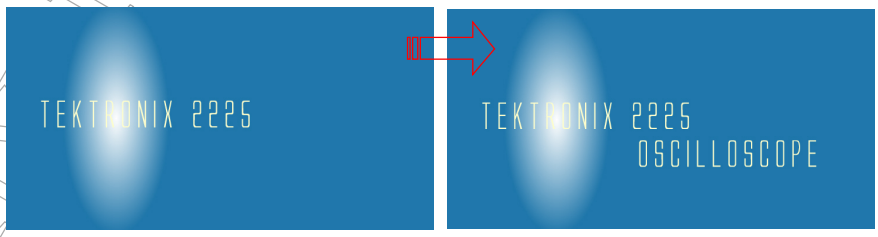

Figure 18: First stage of Flash Intro design

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Figure 19: Second stage of Flash Intro design

Figure 19 shows the second stage of development for the intro. This particular design used a fading in and fading out effect of the words. As one word fades in, then starts to fade out the next word fade in as the word before it fades out. This was a much smoother running movie and using a darker colour for the text helps it stands out and is legible.

This seem to be a very basic intro, there wasn't much going on in this clip, so adding pictures made it more interesting. Figure 20 shows a development from figure 19.

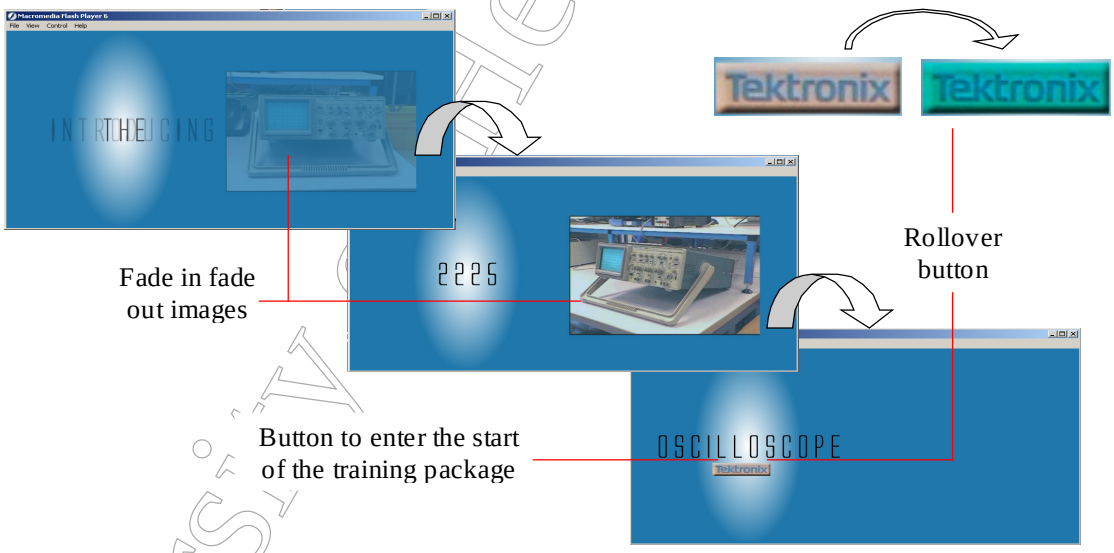

Figure 20: Third stage of Flash Intro

Design uses fading in & fading out of oscilloscope images. A button was also added to link the intro to the homepage of the training package.

5.8.1 Final Flash Intro Design

Figure 21 shows the final design for the intro. Instead of using fade in and fade out images I have used a puzzle form for making up the image. This is more effective. The image was split up into squares using Adobe Photoshop. Each image was saved separately and imported into Flash MX. A separate movie was created for this animation, placing the images on to different layers of the timeline to create this sliding puzzle effect. 14 different layers were used.

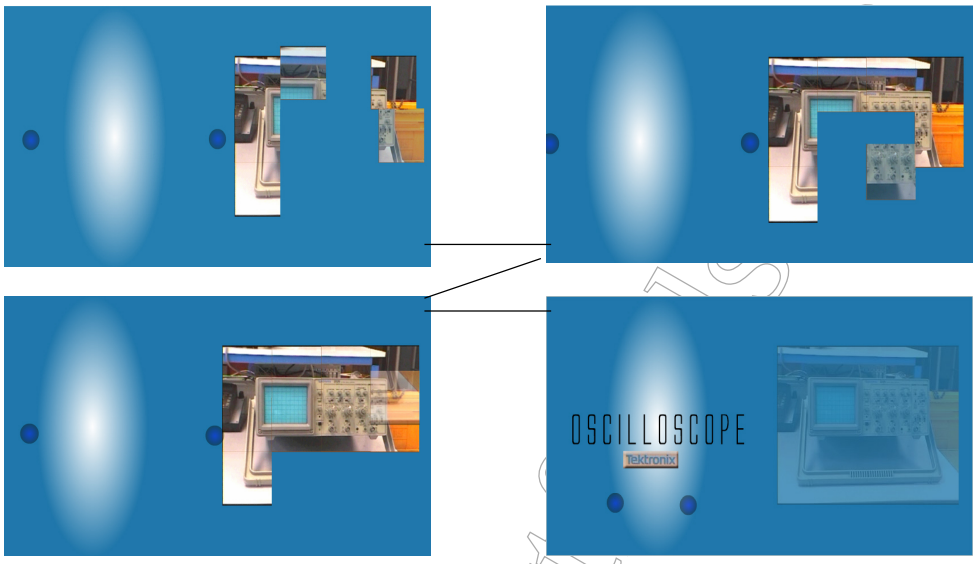

Figure 21: Final Flash Intro design

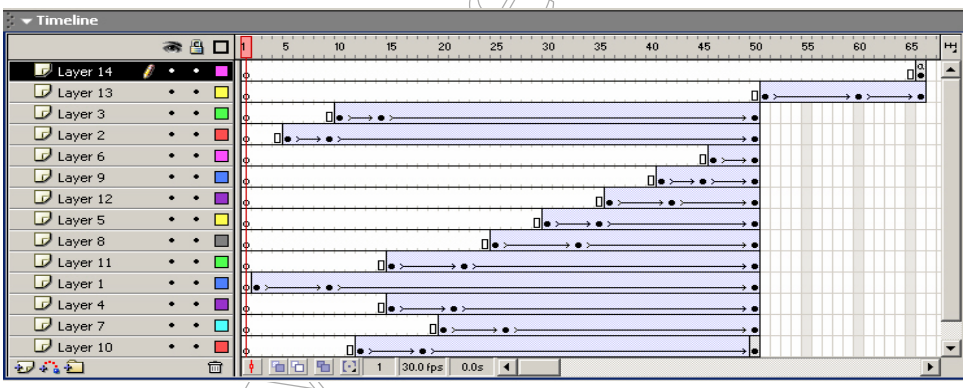

Figure 22: Time line of oscilloscope puzzle animation

CHAPTER 6
Implementation

6.1 Package implementation

It has been discussed in the previous chapter about the package design. The design and basic implementation of the general package layout and flash introduction have been explained and discussed for each particular design. This section concentrates on the training package implementation as a whole. Work through of discussions of various parts of the package and encountering the problems and solving of problems.

6.2 Home page implementation

The home page was design as a welcome page for the user. This is what they first see once they have viewed the flash intro. It is an introduction to the package telling the user what the package is about and what it has to offer.

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Rollover buttons to the side of the page (scope screen image) were used to view the information on this page. These buttons were created in Flash, first creating it as a graphic then converting the behaviour to a button. The colours of the button change once it is rolled over to indicate to the user that the button is active and an action will appear. Refer to figure 23.

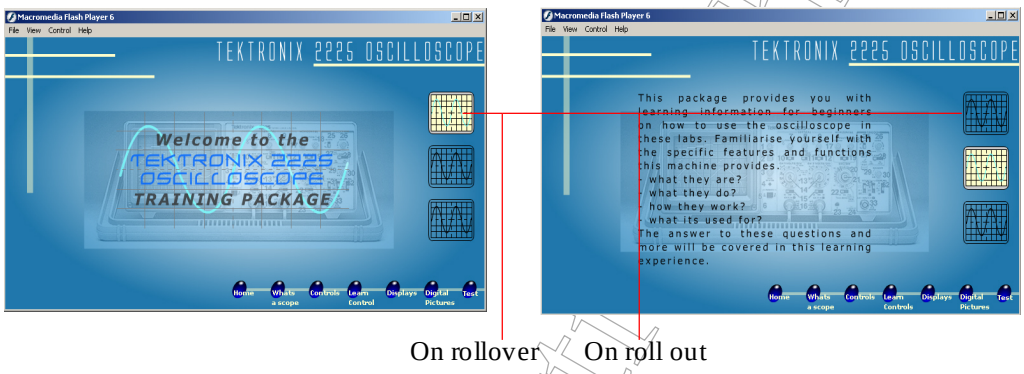
TEKTRONIX 2225 OSCILLOSCOPE
Welcome to the
TEKTRONIX 2225
OSCILLOSCOPE
TRAINING PACKAGE
TEKTRONIX 2225 OSCILLOSCOPE
This package provides you with learning information for beginners on how to use the oscilloscope in these labs. Familiarise yourself with the specific features and functions this machine provides.
- what they are?
- what they do?
- how they work?
- what its used for?
The answer to these questions and more will be covered in this learning experience.
On rollover
On roll out

Figure 23: Rollover buttons and home intro information

6.2.1 How the animation worked originally

The information that appears when you rollover the scope buttons was in a separate movie. This movie was then dragged onto the workspace and action scripting on the buttons were added to call the particular layer/frame action from that movie. Refer to figures 24. The movie must be given an instance name otherwise the action on the button would not have worked.

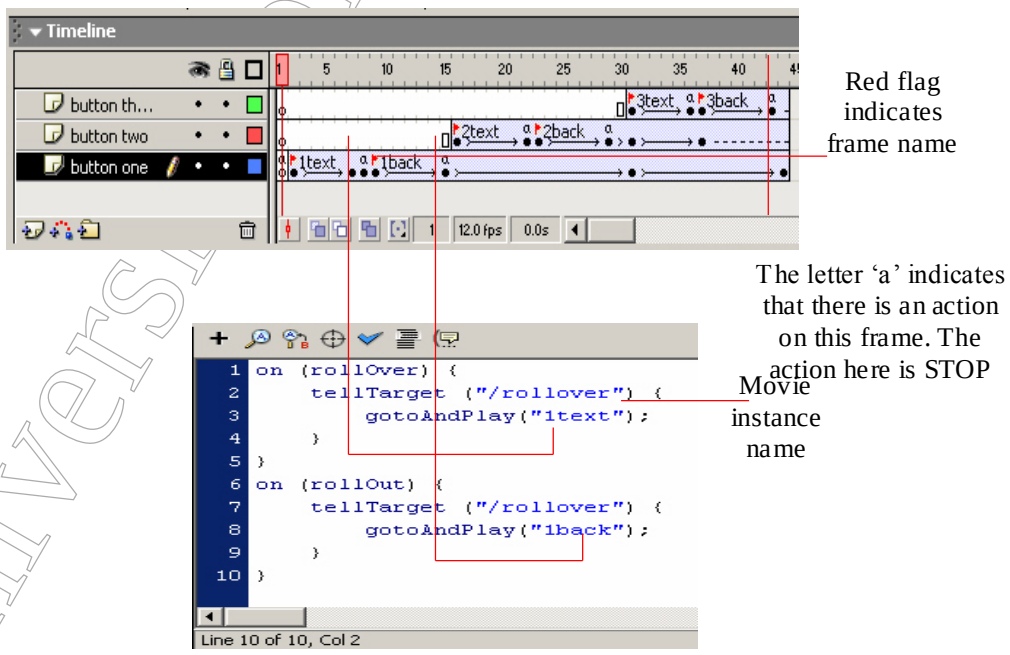

Figure 24: Action scripting for the first scope button

6.2.2 Explanation of the Action Scripting

In the action scripting a Tell Target function is used. This creates an action where by it tells target when on rollover to look in the movie with the instance name for example here it is rollover and it tells it to

'go to and play' the frame with the name "1text". On rollout target is told to look in that same movie with the instance name rollover and tell it to 'go to and play' the frame with the name "1back". Stop actions are added in the timeline, so once the movie is played then reaches this frame in the timeline the movie will stop playing.

6.2.3 Problems

Problem 1

Originally the home page is where the main point was where all the other movies would open up in. To do this a blank movie was added to the timeline layer and given an instance name. Every time a button on the navigation bar was click on the page would appear in that blank movie on the home page. This works but because there was information e.g. images and text on the homepage, when clicked on a button to go to the next page there would be a brief second where the homepage would be seen before the page intended to go to appeared.

Problem 2

Also when going back to the home page and rolled over the scope buttons the information that is meant to appear would not appear.

6.2.4 Solving problems

Problem 1

In order to solve this problem changes had to be made. Instead of having the other pages of the package open up the home page, the actions that were applied to the buttons is as follows: -

```
}
on (release) {
    loadMovieNum("oscilloscopeMenu3.swf", 0);
}
```

Each of the pages of the package was saved as separate files. This action means when the button is released 'load movie' and in brackets is the name of the movie in this case 'oscilloscopeMenu3.swf' that it will open. All the .swf movies must be saved in the same folder. The movies load up separately and mot as part of the home page.

Problem 2

To over come this problem the actions on the buttons that were calling the movie had to be deleted and the animation had to be changed. The buttons had to be converted to a movie and separate movies of the information that appears had to be created. Figure 25 illustrates this.

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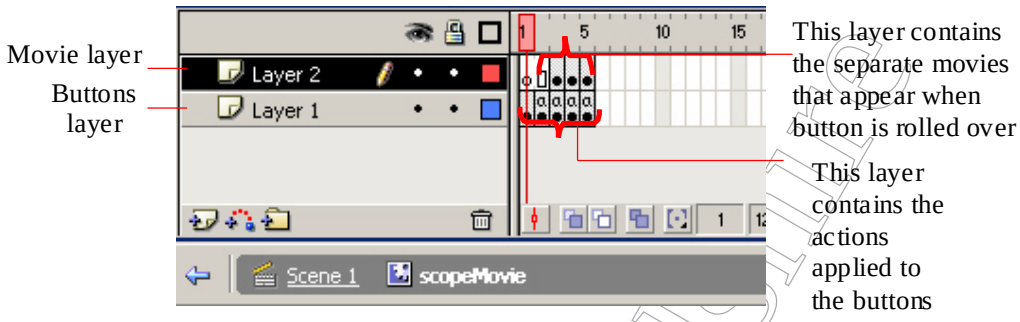
Movie layer
Buttons layer
Layer 2
Layer 1
Scene 1
scopeMovie
This layer contains the separate movies that appear when button is rolled over
This layer contains the actions applied to the buttons

Figure 25: Timeline of scope button movie

Here is the action script applied to the buttons of the buttons layer.

First button

```
on (rollOver) {
        gotoAndPlay(3);
}
on (rollOut) {
        gotoAndPlay(1);
}
```

Second button

```
on (rollOver) {
        gotoAndPlay(4);
}
on (rollOut) {
        gotoAndPlay(1);
}
```

Third button

```
on (rollOver) {
        gotoAndPlay(5);
}
on (rollOut) {
        gotoAndPlay(1);
}
```

On the buttons layer the frames are duplicated so when the movies are played from the top layer the buttons do not disappear. The formality that has been created here is a movie

playing within another movie. Stop action is added to the frame to stop it from playing further until another command is set.

6.3 Navigation Implementation

The navigational structure was implemented on the home page first and then a template of this page was created and used for the rest of the pages of the package. The templates were used in order to keep consistency throughout the package.

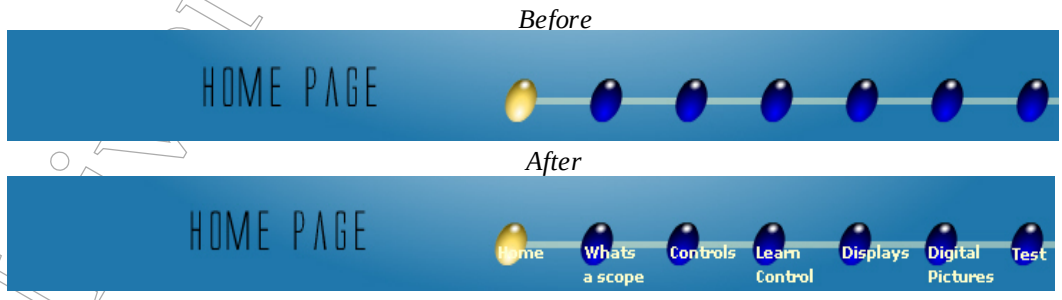

Figure 26: Navigation bar before & after

The animation for the navigation works in the same way as the action scripting described in section 6.2.2 see appendix F section (a) Which shows the action scripting and timeline for the navigation bar.

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Originally the navigation bar button had no text to show what each button represents, only when the button was rolled over could you tell what the button was. After development text was added so it was easily recognised as a navigation bar and with out having to rollover the button you would know which button was link to which page.

6.3.1 Problem

When in putting the text on the buttons, they were difficult to hover over. Text would be recognised as a selectable icon. In order to click on the button the cursor would have to hover over just the button and not the text. This would be rather frustrating for the user. To over come this problem when creating the text in the properties dialog box for the text the icon 'selectable' should not be selected. If this is selected it indicates the text is selectable on screen. Using this text can also be used to create buttons.

6.4 'What is an oscilloscope' page implementation

This page contents information about what an oscilloscope is. To present this information to the user a scrolling method of text was to be implemented. Refer to appendix F section (b) which, shows a screen shot of the first method of implementation for this page. This page also contains a link that goes to a page with information about waves, explaining the meanings of the functions of a waveform and other types of waveforms.

6.4.1 Problem

When creating the scrolling text errors would appear each time it was tested. The reason being was that the textual information for the page was written in the action scripting and it would not recognised some characters such as, explanation marks, comers, speech marks and bullet points. Then arrows were used as buttons to scroll the text up and down. Due the problem of the text not being recognised these down did not work.

6.4.2 Problem Solution

To over come this problem of the text not being read a different method was used to create the scrollable text box. A new movie animation was created. In this the written information was written in a text box field. Instead of using buttons for scrolling text up and down, a scroll bar was inputted from the components tool in Flash MX. This movie was then dragged on to the existing page on a different layer. Refer to appendix F section (c) it shows a screen shot of the final method of implementation for this page.

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6.5 Controls page implementation

This page is part of a sub page, which has a menu within, that goes to the controls profile. The creation of this page was straightforward. Creating a button to enlarge the oscilloscope image, which when it is clicked on, the image is swap to a different image. This method for enlarging the image was used rather then creating an animated timeline so that the user is able to view the image as they please.

The drop down menu was created as a separate animation. When the image is hovered over the drop down menu appears allowing the user to select/click on the button of the group of controls they wish to see. To see a screen shot and explanation of drop down menu refer to appendix F section (d).

6.5.1 Controls Profile implementation

This page shows information about the controls, the name, and the function of the control and recommended use of the control. To implement this idea the image of the scope was broken up into the numbered sections displayed on the image. There are 33 controls for the scope so the menu was split into 4 sections. The first three containing 10 controls and the last containing the last 3 controls. Each menu displays the number of the control and when hovered over an animation appears showing the information about the control.

6.5.2 Problems

Creating the animation for this section was founded to be rather tricky. Creating the animation at first was created the same way as the animation for the navigation bar. But this limited the design of the animation.

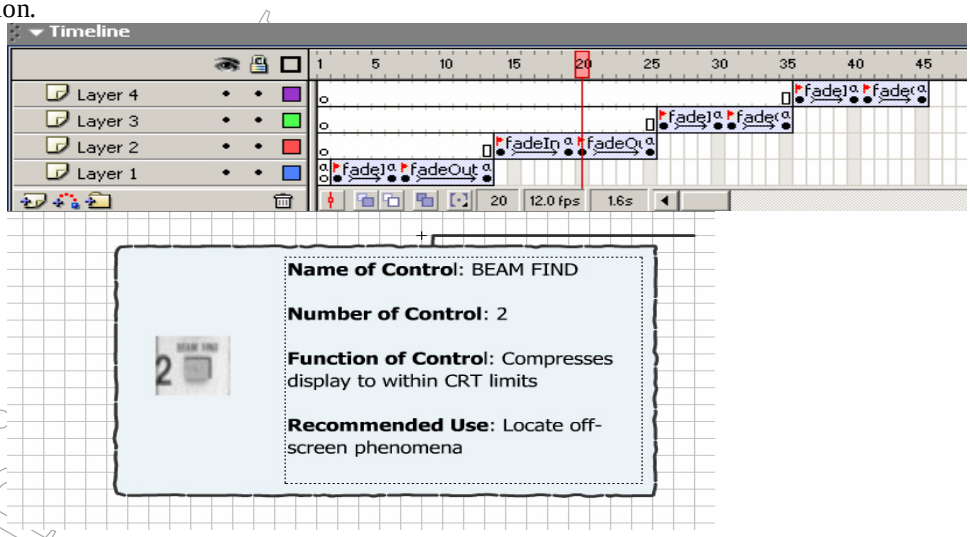

Figure 27: First implemented animation for controls

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The idea initially was to break up the image shown above, as separate graphics e.g. the bar would fade in then the background then the image and finally the text, but because this was not possible the whole image had to be saved as one graphic.

To create the animation as designed in logbook a different approach to the animation had to be taken.

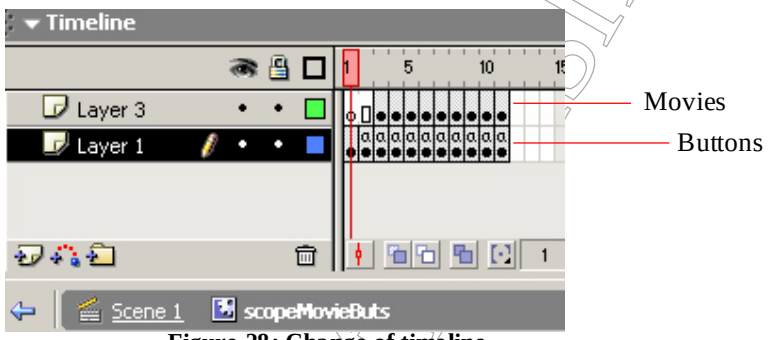

Figure 28: Change of timeline

6.5.2 Problem solved

Figure 30 shows the change of development for this animation. Separate individual movies were created for each control this enabled the animation that was intended initially e.g. having the sequence of events appearing one after the other. The buttons were created as a movie, which call the individual control movies. Again using movie within a movie method.

6.6 Learning the controls

Summarising this page of the package, a flash intro introduces the page before the user clicks the enter button where a new page is opened up where the information on how the initial settings of the controls should be set are show in a diagram form. User is able to skip the intro by clicking on the skip button. A button linked to the summary of the controls is also available on this page.

A flash animation of the oscilloscope was incorporated in the design to bring interest and animation to the package. Making the user interested in what else the package might have to offer.

6.7 Displays

The display menu has a lot of information for the user. In order to make this information manageable to the reader it has been split in to 4 sections Display controls, vertical controls, horizontal controls and trigger controls. The same sort of method movie within a movie was used. Figure 29 illustrates this.

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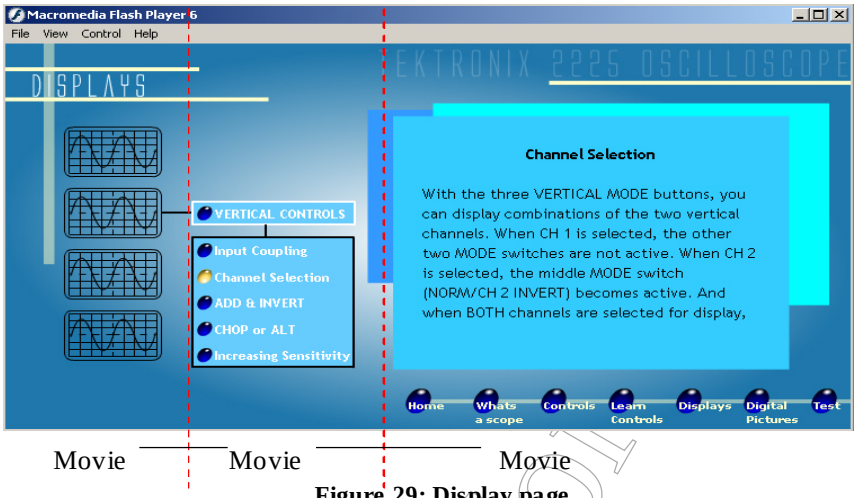
Macromedia Flash Player 6
File View Control Help
DISPLAYS
TEKTRONIX 2225 OSCILLOSCOPE
VERTICAL CONTROLS
Input Coupling
Channel Selection
ADD & INVERT
CHOP or ALT
Increasing Sensitivity
Channel Selection
With the three VERTICAL MODE buttons, you can display combinations of the two vertical channels. When CH 1 is selected, the other two MODE switches are not active. When CH 2 is selected, the middle MODE switch (NORM/CH 2 INVERT) becomes active. And when BOTH channels are selected for display,
Home
Whats a scope
Controls
Learn Controls
Displays
Digital Pictures
Test
Movie
Movie
Movie

Figure 29: Display page

6.7 Oscilloscope pictures

The pictures were taken using a digital camera. Different angles of the scope were taken and the best 6 were chosen to place in the package. The background of the picture slide was designed and created in Adobe Photoshop. The buttons were also created in Adobe Photoshop. To create these two images the rectangle tool was used to create the basic shape required. Then using layer prosperities was able to manipulate and change the look of the shape creating a 3D look to the image to give it depth and make it look realistic.

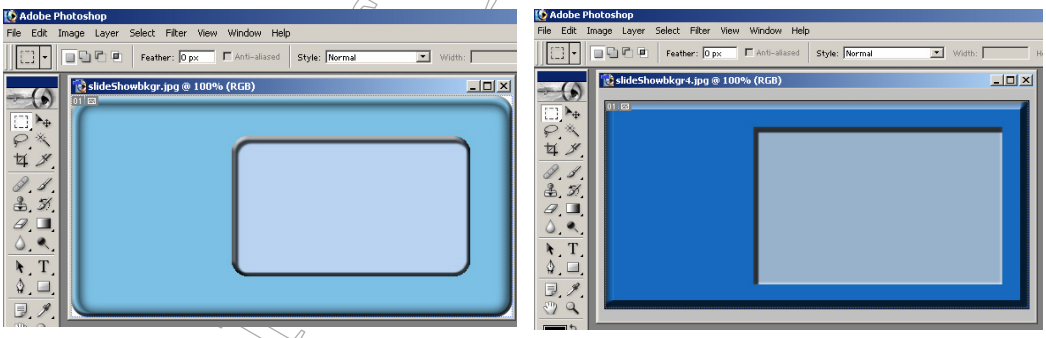
Adobe Photoshop
File Edit Image Layer Select Filter View Window Help
slideShowbkgr.jpg @ 100% (RGB)
Adobe Photoshop
File Edit Image Layer Select Filter View Window Help
slideShowbkgr4.jpg @ 100% (RGB)

Figure 30: First and final design of photo background using Adobe Photoshop

Figure 31: Design of button for photo slide

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6.8 The Test

The test was created to test the knowledge of the students once they have run through the package. To create this test 8 questions are asked and the student has a choice of two answers a or b. If they get the question right there is a scoreboard at the top of the page that indicates to the user whether they have got the question right or whether they have got it wrong. Scores of plus 10 for a right answer and minus 10 for a wrong answer indicate to the user whether the question they answered is right or wrong. Here's an example of the action script that is added to the buttons a and b of the first question on the second part of the test.

Button (a)

```
on (release) {
    _root.total = _root.total - 10;
}
```

Button (b)

```
on (release) {
    _root.total = _root.total + 10;
}
```

A variable name is given to the text box that shows the score. The variable is named 'total' so the action above tells it to display the answer in that text box.

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CHAPTER 7
Testing

When the package is completed a method of testing has to take place. This is done to insure that functionality of the package is running well and encounter any problems that may have been over looked during the implementation of the package. It is an essential part of the project process providing the developer with answer on how well the package is working in the environment it has been designed for.

7.1 Method of testing

The most common procedure of testing is called Black Box testing. This involves testing the package once it is fully completed insuring the requirements are met. It focuses on the testing of functional requirements.

During the package development testing also took place while the package was being implemented. The problems that were encountered during the production of the package as specified in the previous chapter indicate the evidence of testing during implementation. Testing needed to be carried out during implementing the package to insure functions and scripting were working well along side each other. It's a procedure of trail and error that takes place during the implementation.

Students and fellow colleagues tested the package, in order to see whether or not the package was running smoothly.

7.2 Viewing results table

To refer to the table of test that took place look at appendix D. This give the full testing that went ahead after the package was full implemented. Below are some notes that refer to the testing table:

Test No.3

The answer to this test is yes and no. Yes because all the sub title animations do work but on the test page of the package the sub title reads 'What is an oscilloscope' when is should read 'test'.

Test No.11

There is fault to the clicking of the scope buttons. This is if you were to click the button twice in one action the animation of the drop menu will open, then when click the same button to close the drop menu the next drop menu would open without you having clicked the next scope button.

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7.3 Feedback

Some of the main pointers that had to be considered while testing the package

- The interaction the user has with the package
- Could the package be said to be user friendly
- Over all layout & design
- The quality of information that has been provided in the package
- Quality of navigation and links

Due to the overall testing of the package as a whole a conclusion can be made that 90% of the package is running well. The idea of creating a test in the package was founded very interesting. All the above points were commented on well although there is room for improvement.

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CHAPTER 8
Evaluation/Conclusion/Further Developments

8.1 Evaluation

The main aim of the project was to create an interactive, multimedia-training package to introduce and aid first time users' i.e. students in understanding how to use an oscilloscope. Instructing the user in operating the basic functions available in an oscilloscope unsupervised or with minimum supervision.

The overall objective of the required package and the user requirements were followed carefully during the development of the package. The following were achieved successfully from the project

- Providing the user/student with useful learning material useful and detailed content
- Provides user with the basic functions of the oscilloscope
- The use of some interactivity were by the introduction of providing a test was included
- Good use of images and developing a creative and imaginative package design
- Providing clear step-by-step and easy to follow instructions to user
- Demonstrate the fundamental requirements for operating an oscilloscope

The following shows the user requirements that were obtained successfully from the project:

- Computer based training package
- User friendly
- Easy to navigate through the package
- Easy to follow instructions & Break down of the relevant information
- Clear use of information & Interesting content
- Eye catching lay out of package

In order to obtain the objectives and user requirements for the package provided to be rather time consuming. Some of the achievements that could not be obtained were use of audio and the ability for user to down load work and print information that they would require. Although audio was not implemented in the package and one of the objectives was to implement this, due to the timing of time management a lot more time was spent on the interactivity of the package, package look and layout and the good use of information material. Looking at it further this is where the main bloke of the project lays so in order to follow this much time was spent to successfully complete these objectives and requirements. It had come to the conclusion that using audio may not be of much use as the package is mainly based on visual communication. Not discarding the audio factor it could still be regarded and looked into as further development.

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Using Macromedia Flash MX to build the package has provided to be time consuming. Producing the individual movies using the time line was where was the most. Although flash has been used in the past they were very basic implementation, learning how to use and incorporate action scripting into the animation was a major part of the project, which also was relatively time consuming.

8.2 Time Management

The reason for time management is to keep to a time scheduling plan in order to keep to date and complete the project in the given time. Creating a Gantt chart to follow during the development of the project was a good way to keep a schedule of project management. A Gantt chart helps to manage tasks by breaking major tasks into more manageable smaller task and setting deadline of completion for the task. Keeping to such a plan leads to a successful end result.

Time keeping was founded to be difficult in completing this project due the vast amount of time spent on implementing. Appendix E indicates the original Gantt chart that was created at the start of the project estimating the time of completion for each of the tasks according to how big the task was. It also shows the revised Gantt chart indicating the adjustments of time for certain tasks e.g. implementation and testing.

8.3 Conclusion

The general report outlines the way the task that was given has been handle. Detailing the procedures been through to implement the project giving the reader a feed back of events over the months and bring the project to a conclusion.

The package was created using the multimedia software application Macromedia Flash MX. Although this package has been rather time consuming to use it has brought good results to the overall completed package. It has benefited the package with the input and creativity of the developer with interactive and animated feature and giving the presentation of work a high quality of viewing. The project as a whole has been a good working experience and has been carried out successfully although future developments can be made.

8.4 Further developments

Further developments can be made to improve the package functionality. For example some of the developments are listed below:

- Introducing audio to aid the user
- The ability to down load
- Incorporating and a lab exercise for the students to follow through
- Incorporating actual lab movies, of students showing how to use the oscilloscope

All the above could be included in a further improvement of the package with investigating the use of other software to develop it on.

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Reference

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[1] http://www.tek.com/Measurement/cgi-bin/framed.pl?

[2] http://www.tek.com/Measurement/App_Notes/XYZs/signal_integrity.pdf

[3] http://physics.ucsd.edu/students/courses/summer2002/ss2/physics2cl/phys2CLmanual.pdf

Waves websites

[4] Section IV http://id.mind.net/~zona/mstm/physics/waves/partsOfAWave/waveParts.htm

[5] www.cpccorp.com/pqglossary.htm

[6] www.liebert.com/support/glossary/power_gloss.asp

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http://www2.sfu.ca/sonic-studio/handbook/Triangle_Wave.html

howstuffworks.com

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http://www.cdsm.co.uk/learning/e_learning.htm

http://www.macromedia.com/software/fireworks/productinfo/reviews_news/

http://www.maxhelp.com/

http://www.macromedia.com/software/flash/?promoid=home_prod_flash_082403

www.kirupa.com

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Appendix Content

A. Questionnaire

B. Questionnaire results

C. Table of controls

D. Testing table

E. Gantt Chart Before & After

F. Action scripting, timelines & screen shots

a) Action scripting and timeline for the navigation bar.

b) Screen shot of the first method of implementation for scrolling text

c) Screen shot of final method of implementation for scrolling text

d) Screen shot of drop down menu

e) Action scripting for control buttons

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Appendix A

QUESTIONNAIRE

(From Saijal Patel, final year BSc project Student)

Please pretend that this is Induction Week and you are in our labs for the very first time

1. Have you used an oscilloscope before? Yes No

2. How useful are the manuals in the labs, for using an oscilloscope? From a scale of 1-5 (1= no use…5 = very useful)

   1 2 3 4 5

3. When using the manual for the first time, was it straightforward to follow?

   Yes No Sort of

4. When using the oscilloscope for the first time would you prefer using a user manual, which is…

   Handout print copy manual On screen/on-line manual Both

5. Have you used an on-line training package before? Yes No

6. If yes how useful had it been to your learning, from a scale of 1-5 (1= no use…5 = very useful)

   1 2 3 4 5

7. What sort of on-line tutorial sites have you used?

_____
_____

8. Do you prefer?

   Information text guide

   An interactive animated guide

   Bit of both

9. Would you have found such a training package useful during your induction week program?

Yes No

Thank you for taking the time to fill out this questionnaire. It has been very much appreciated

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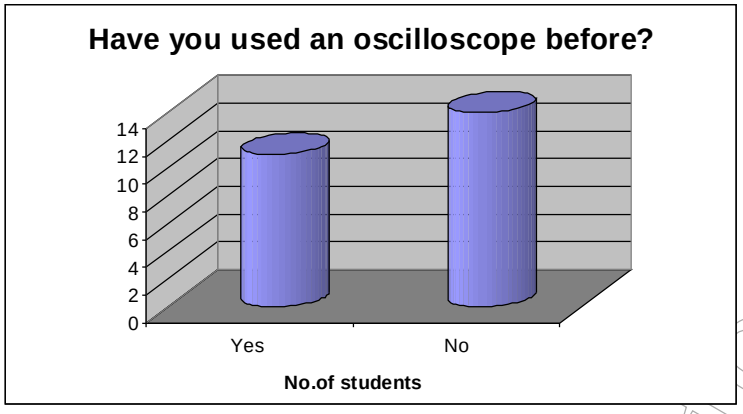
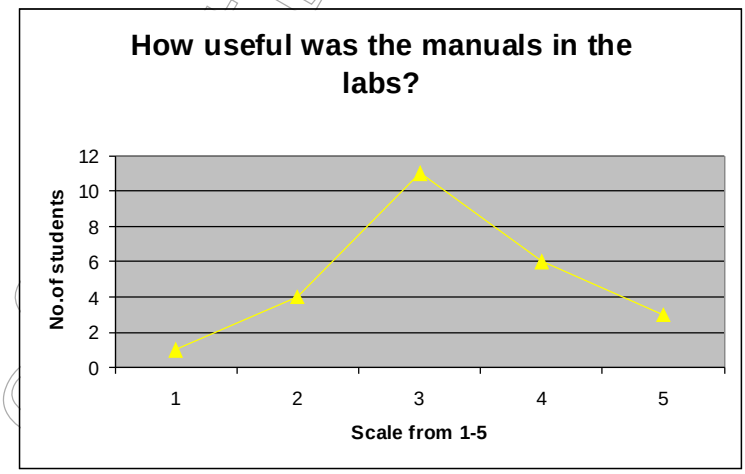
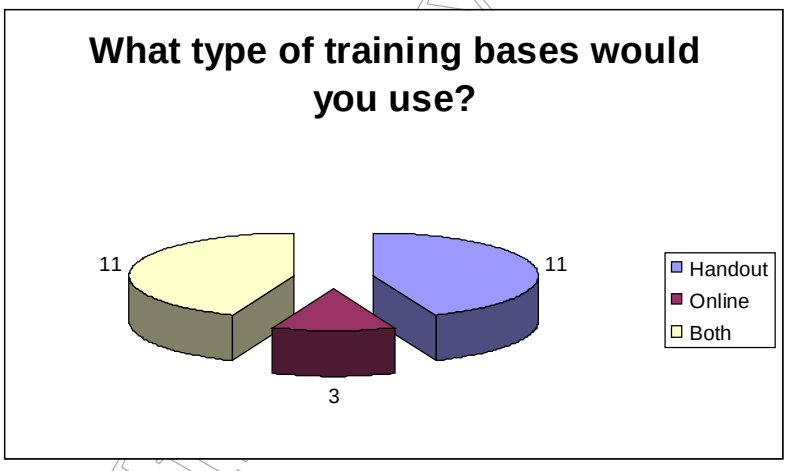
Appendix B

Questionnaire results in graph format

These are the graph of the questions that were of most importance.







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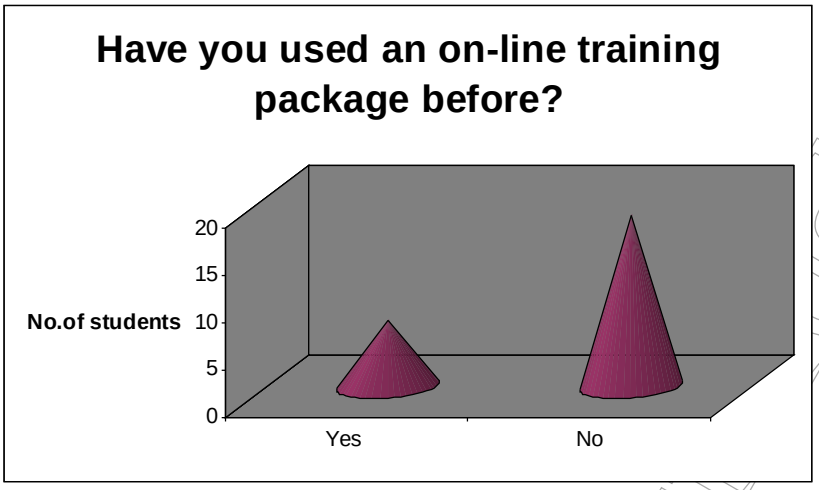

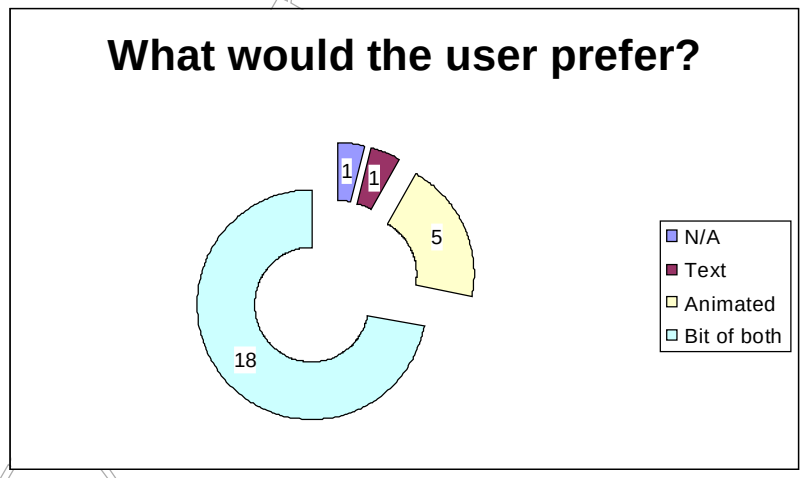

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Appendix C

No.	Title	Function	Recommended Use
1	INTENSITY	Adjusts trace brightness.	Compensate for ambient lighting, trace speed, trigger frequency.
2	BEAM FIND	Compresses display to within CRT limits.	Locate off-screen phenomena.
3	FOCUS	Adjusts for finest trace thickness.	Optimize display definition.
4	TRACE ROTATION	Adjusts trace parallel to centerline.	Compensate for earth's field.
5	POWER	Turns power on and off.	Control power to the instrument.
6	Power Indicator	Illuminates when power is turned on.	Know power condition.
7, 9	POSITION	Moves trace up or down screen.	Position trace vertically and compensate for dc component of signal.
8	TRACE SEP	Moves the magnified trace vertically with respect to the unmagnified trace when HORIZONTAL MODE is set to ALT.	Position unmagnified and horizontally magnified traces for convenient viewing and measurement.
10	CH 1- BOTH - CH 2	Selects signal inputs for display.	View either channel independently or both channels simultaneously
11	NORM-INVERT	Inverts the Channel 2 signal display.	Provide for differential (CH 1 - CH 2) or summed (CH 1 + CH 2) signals when ADD is selected.
12	ADD-ALT-CHOP	ADD shows algebraic sum of CH 1 and CH 2 signals. ALT displays each channel alternately. CHOP switches between CH 1 and CH 2 signals during the sweep at 500 kHz rate.	Display summed or individual signals.
13	VOLTS/DIV	Selects vertical sensitivity.	Adjust vertical signal to suitable size.
14	Variable (CAL)	Provides continuously variable deflection factors between calibrated positions of the VOLTS/DIV switch. Reduces gain by at least 25:1. The CAL control can be pulled out to vertically magnify the trace by a factor of 10. Limits bandwidth to 5 MHz.	Match signals for common mode readings. Adjust height of pulse for rise-time calculations. Inspecting small signals.
15	AC-GND-DC	In AC, isolates dc component of signal. In GND, gives	Selects method of coupling input signals to the vertical deflection

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		reference point and allows recharging of input coupling capacitor. In DC, couples all components of signal.	system.
16	CH 1 OR X CH 2 OR Y	Provides for input signal connections. CH 1 gives horizontal deflection when SEC/DIV is in X-Y.	Apply signals to the vertical deflection system.
17	POSITION COARSE	COARSE is convenient for moving unmagnified traces	Control trace positioning in horizontal direction.
18	POSITION FINE	FINE is convenient for moving magnified traces when either ALT or MAG is selected.	Control trace positioning in horizontal direction.
19	X1 -ALT- MAG	X1 displays only normal (horizontally unmagnified) waveform. ALT displays normal and magnified waveforms alternately. MAG displays only the magnified waveform.	Select normal, comparative or expanded waveforms.
20	SEC/DIV	Selects time-base speed.	Set horizontal speed most suited to requirements.
21	Variable (CAL)	Provides continuously variable uncalibrated sweep speeds to at least 2.5 times the calibrated setting.	Extend the slowest speed to at least 1.25 s/div
22	MAG(X5 - X10 - X50)	Selects degree of horizontal magnification.	Examine small phenomena in detail.
23		Provides safety earth and direct connection to signal source.	Chassis ground connection.
24	PROBE ADJUST	Provides approximately 0.5-V,1-kHz square wave.	Match probe capacitance to individual circuit. This source may be used to check the basic functioning of vertical and horizontal circuits but is not intended to check their accuracy.
25	SLOPE	Selects the slope of the signal that triggers the sweep.	Provide ability to trigger from positive-going or negative-going signals.
26	LEVEL	Selects trigger-signal amplitude point.	Select actual point of trigger.
27	TRIG'D	Indicator lights when sweep is triggered in P-P AUTO, NORM, or TV FIELD.	Indicate trigger state.
29	RESET	Arms trigger circuit for SGL SWP.	
30	HOLDOFF	Varies sweep holdoff time 10:1.	Improve ability to trigger from aperiodic signals.
31	SOURCE	CH 1, CH 2, and EXT trigger signals are selected directly. In VERT MODE, trigger source is determined by the	Select source of signal that is coupled to the trigger circuit.

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		VERTICAL MODE switches as follows: CH 1: trigger comes from Channel 1 signal. CH 2: trigger comes from Channel 2 signal. BOTH-ADD and BOTH CHOP: trigger is algebraic sum of Channel 1 and Channel 2 signals. BOTH-ALT: trigger comes from Channel 1 and Channel 2 on alternate sweeps.			
32	COUPLING	AC blocks dc components and attenuates signals below 15 Hz. LF REJ blocks dc components and attenuates signals below about 30 kHz. HF REJ blocks dc components and attenuates signals above about 30 kHz. DC couples all signal components.		Select how the triggering signal is coupled to the trigger circuit.	
33	EXT INPUT	Connection for applying external signal that can be used as a trigger.	Connection for applying external signal that can be used for intensity modulation.	Trigger from a source other than vertical signal. Also used for single-shot application.	Provide reference blips by intensity modulation from independent source.

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Appendix D

Test No.	File name	Testing Action	Expected result	Does it work	
				Yes	No
1	*Navigation Animations ALL*	ALL Navigation Rollover animation	On rollover of navigation buttons animation should play	✓	
2	*Navigation Links ALL*	ALL Navigation Links	On click should go to the page that is requested	✓	
3	*Sub titles*	ALL Animations	On viewing a requested page sub title animation should play	✓	✓ *See Notes below*
4	Intro.exe (Flash Intro Page)	Flash Intro	Once clicked on file flash intro animation should play	✓	
		Enter Button (TEKTRONIX)	Once clicked on button, should go to home page of package	✓	
5	oscilloscopeMenu2.swf (Home Page)	Rollover scope buttons	On rollover animation should play	✓	
6	oscilloscopeMenu3.swf (What is an oscilloscope Page)	Scroll Bar	When click on the arrows of the scroll bar or move the bar up or down text should move too	✓	
		Flash Scope animation on right	Once entered the page animation should work in a continues loop	✓	
		Rollover button (find out more on waves) & Button link	The button 'find out more about waves' on rollover image should change & on click go to the page requested	✓	
7	oscilloscopeMenu4.swf	Scope image animation	When entered into this page scope animation should be played	✓	

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	(Controls Page)	Button 'Click to enlarge image' Rollover & action	On rollover image should change colour and the enlarge action should work once clicked on	✓
		Drop down menu	On rollover drop down menu should appear	✓
		Drop down menu links	On click the button requested should go to the requested page	✓
8	oscilloscopeMenu5.swf (Learning the controls)	Intro flash animation for page	On entering the page flash intro animation for page should play	✓
		'Click to begin' button	On rollover button image should change and on click should load oscilloscopeMenu5b.swf movie (next part to the page)	✓
9	oscilloscopeMenu5b.swf (Learning the controls) next part to the page before	Flash animation	On entering the page flash animation for page should play	✓
		Skip button	On click should skip the flash animation	✓
		'Here' button	On click should load oscilloscopeMenu5c.swf movie (next part to the page)	✓
10	oscilloscopeMenu5c.swf (Learning the controls) next page to previous page	Scroll Bar	When click on the arrows of the scroll bar or move the bar up or down text should move too	✓
11	oscilloscopeMenu6.swf (Displays)	Rollover scope buttons & Button links	Scope images should change colour once rolled over. On click buttons should animation a drop menu showing other headings & buttons	✓

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	See notes below	Drop menu button links	These buttons should display information once clicked on	✓
		Display Button rollover and link	Button should change image on rollover. Link should go to next bit of information	✓
		Next display button and link	Button should change image on rollover. Link should display scope screen animation	✓
		Display screen animation	Animation should run as planned	✓
		Scrolling bars	When click on the arrows of the scroll bar or move the bar up or down text should move too	✓
12	oscilloscopeMenu7.swf (Digital pictures page)	Button 1-6 on the panel	On clicking on these buttons different pictures should appear for each button. (Six different images in total)	✓
13	oscilloscopeMenu8.swf (Test part 1)	(a) & (b) answer buttons all	All the answer buttons should be in working order. Each button giving a positive or negative number depending on if answer is right or wrong	✓
		Keeping score	Once an answer is selected then the score board should show the score	✓
		Next button	On rollover colour should change. On click should load oscilloscopeMenu8b.swf movie (test part 2)	✓
14	oscilloscopeMenu8a.swf (Test intro)	Flash intro	Once entering this page test flash intro should play	✓
		Rollover button 'click to begin' and link	On rollover colour should change and on click should load oscilloscopeMenu8.swf movie (test part 1)	✓

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15	oscilloscopeMenu8b.swf (Test part 2)	(a) & (b) answer buttons all	All the answer buttons should be in working order. Each button giving a positive or negative number depending on if answer is right or wrong	✓
		Keeping score	Once an answer is selected then the score board should show the score	✓
16	oscilloscopeMenu9.swf (Waves)	Sinusoidal wave animation	On entering the page the animation should play	✓
		Scroll bar	When click on the arrows of the scroll bar or move the bar up or down text should move too	✓
		Amplitude, wavelength, frequency, phase, sinusoidal, other waveforms rollover & links	When buttons are rolled over colour of test should change. When clicked on these buttons information should be shown for each of the titles. 'Other waves' button should load oscilloscopeMenu10.swf movie.	✓
17	oscilloscopeMenu10.swf (Other waves)	Animation	On entering this page animation should play	✓
18	Controls1.swf (Controls 1-10)	Rollover button 1-10	On rollover of each button the information animation should appear	✓
19	Controls2.swf (Controls 11-20)	Rollover button 11-20	On rollover of each button the information animation should appear	✓
20	Controls3.swf (Controls 21-30)	Rollover button 21-30	On rollover of each button the information animation should appear	✓

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21	Controls4.swf (Controls 31-33)	Rollover button 31-33	On rollover of each button the information animation should appear	✓

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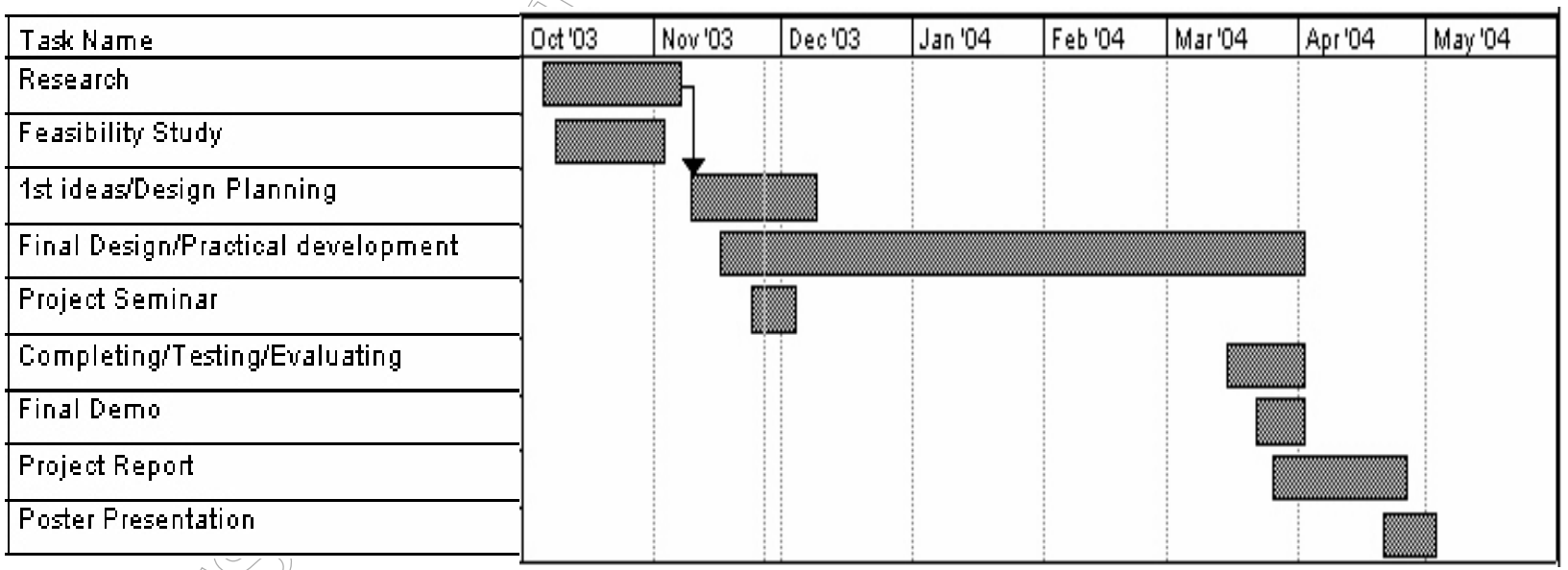
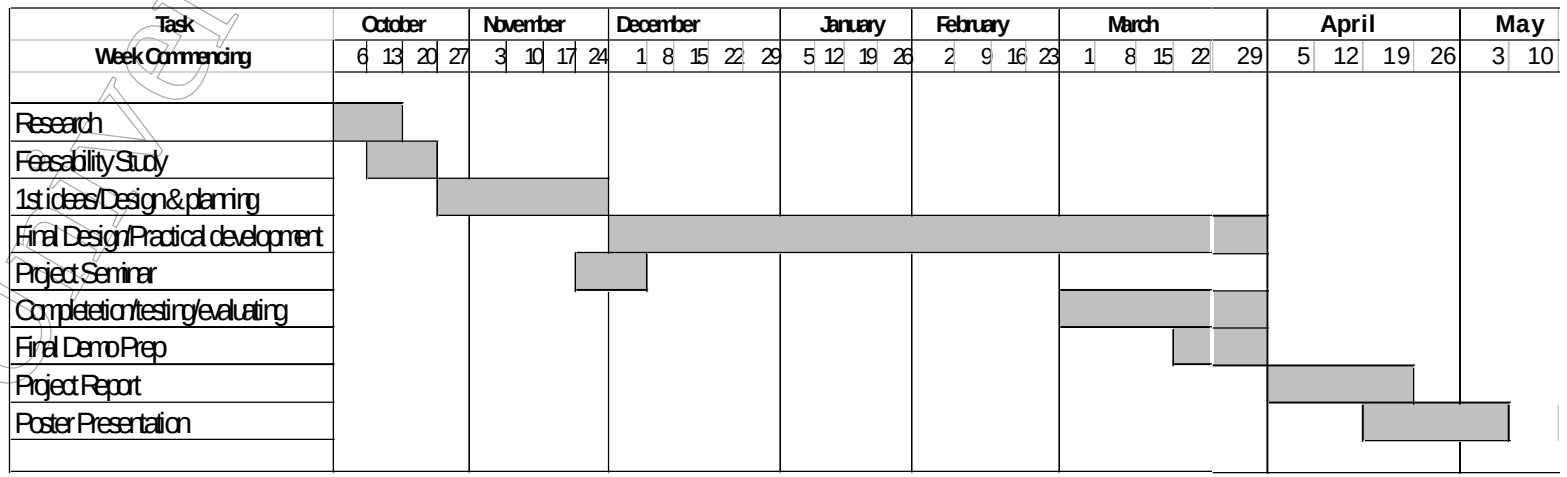
Appendix E

Gantt Chart

Original



Revised



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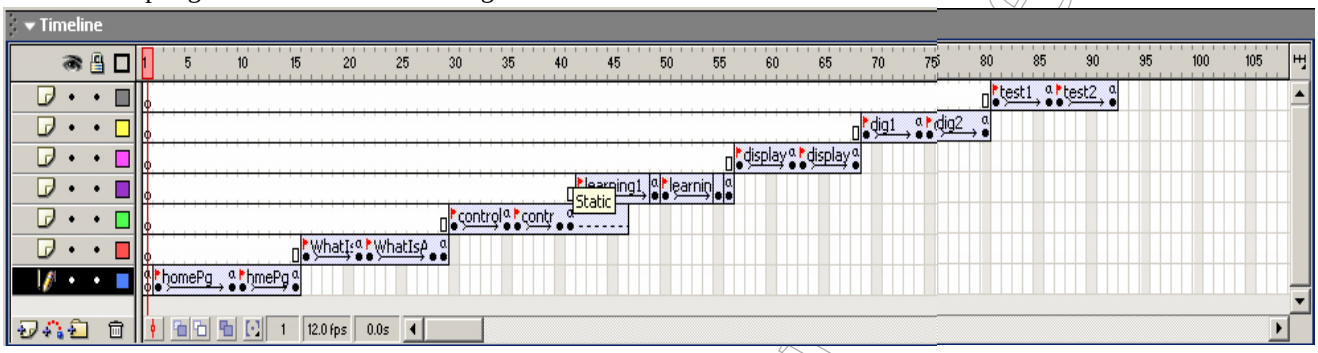
Appendix F

Section (a)

Action scripting and timeline for the navigation bar



Section (a) continued on next page

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Action scripting	*Button*
on (rollOver) { *tellTarget ("/rolloverNav") {* *gotoAndPlay("homePg");* *}* *}* *on (rollOut) {* *tellTarget ("/rolloverNav") {* *gotoAndPlay("hmePgBck");* *}* *}* *on (release) {* *loadMovieNum("oscilloscopeMenu2.swf", 0);* *}*	**First button** Rollover animation On click action on button to load .swf movie
on (rollOver) { *tellTarget ("/rolloverNav") {* *gotoAndPlay("WhatIsAScope");* *}* *}* *on (rollOut) {* *tellTarget ("/rolloverNav") {* *gotoAndPlay("WhatIsAScope2");* *}* *}* *on (release) {* *loadMovieNum("oscilloscopeMenu3.swf", 0);* *}*	**Second Button**
on (rollOver) { *tellTarget ("/rolloverNav") {* *gotoAndPlay("Controls");* *}* *}* *on (rollOut) {* *tellTarget ("/rolloverNav") {* *gotoAndPlay("Controls2");* *}* *}* *on (release) {* *loadMovieNum("oscilloscopeMenu4.swf", 0);* *}*	**Third Button**
on (rollOver) { *tellTarget ("/rolloverNav") {* *gotoAndPlay("learning1");* *}* *}* *on (rollOut) {* *tellTarget ("/rolloverNav") {* *gotoAndPlay("learning2");* *}* *}* *on (release) {* *loadMovieNum("oscilloscopeMenu5.swf", 0);* *}*	**Fourth Button**
on (rollOver) { *tellTarget ("/rolloverNav") {* *gotoAndPlay("display1");*	**Fifth Button**

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```
        }
}
on (rollOut) {
        tellTarget ("/rolloverNav") {
                gotoAndPlay("display2");
        }
}
on (release) {
        loadMovieNum("oscilloscopeMenu6.swf", 0);
}
```

Sixth Button

```
on (rollOver) {
        tellTarget ("/rolloverNav") {
                gotoAndPlay("dig1");
        }
}
on (rollOut) {
        tellTarget ("/rolloverNav") {
                gotoAndPlay("dig2");
        }
}
on (release) {
        loadMovieNum("oscilloscopeMenu7.swf", 0);
}
```

Seventh Button

```
on (rollOver) {
        tellTarget ("/rolloverNav") {
                gotoAndPlay("test1");
        }
}
on (rollOut) {
        tellTarget ("/rolloverNav") {
                gotoAndPlay("test2");
        }
}
on (release) {
        loadMovieNum("oscilloscopeMenu8a.swf", 0);
}
```

Section (b)

Screen shot of the first method of implementation for scrolling text

Macromedia Flash Player 6
File View Control Help
WHAT IS AN OSCILLOSCOPE
TEKTRONIX 2225 OSCILLOSCOPE
FootPrints In the Sand
One night I dreamed I was walking along the beach with the Lord. Many scenes from my life flashed across the sky. In each scene I noticed footprints in the sand. Sometimes there were two sets of footprints. Other times there were one set of footprints. This bothered me because I noticed that

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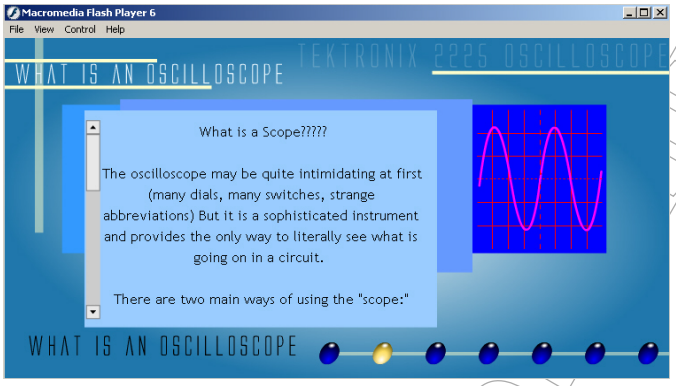
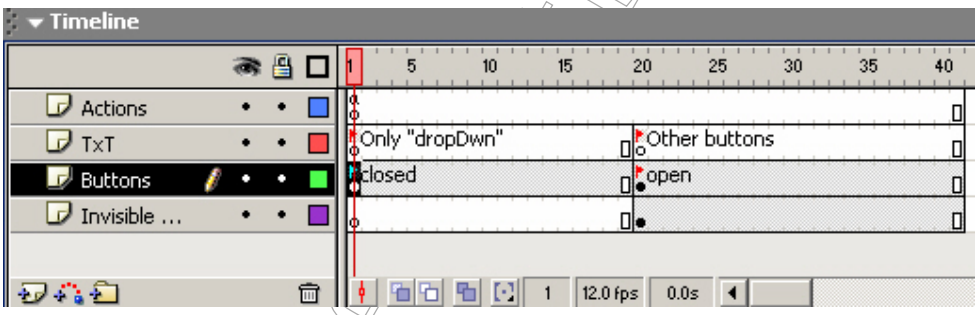
Section (c)

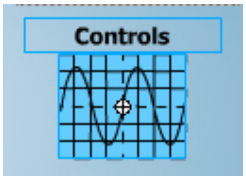
Screen shot of final method of implementation for scrolling text


Macromedia Flash Player 6
File View Control Help
WHAT IS AN OSCILLOSCOPE
TEKTRONIX 2225 OSCILLOSCOPE
What is a Scope?????
The oscilloscope may be quite intimidating at first (many dials, many switches, strange abbreviations) But it is a sophisticated instrument and provides the only way to literally see what is going on in a circuit.
There are two main ways of using the "scope:"
WHAT IS AN OSCILLOSCOPE

Section (d)

Screen shots of drop down menu timeline and image on screen





When the cursor does not rollover the image shown on the left, the animation sets the drop down menu as closed. Action script is written to the image:

```
on (rollOver) {
        gotoAndStop("open");
}
```

Once the image is rolled over it is saying ‘ go to and play’ frame named open. See figure on next page.

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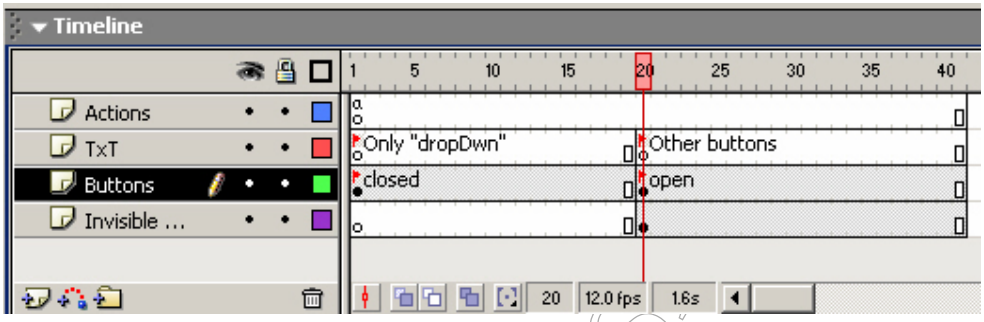

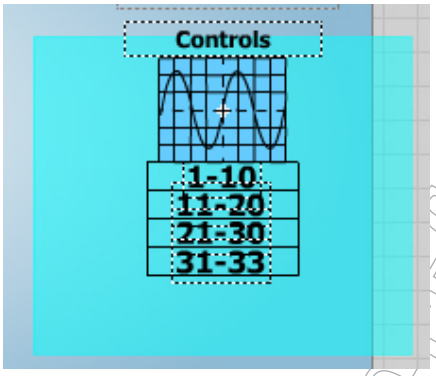

Once the image is rolled over the drop down menu will appear. The rectangle boxes are buttons that link to other pages, which holds information about the controls.

Section (e)

Example of the action scripting used for the buttons on the controls 1-10 page

Action script	Control Number

on (rollOver) {
gotoAndPlay(3);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 1

on (rollOver) {
gotoAndPlay(4);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 2

on (rollOver) {
gotoAndPlay(5);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 3

on (rollOver) {
gotoAndPlay(6);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 4

on (rollOver) {
gotoAndPlay(7);
}
on (rollOut) {
gotoAndPlay(1);
	Control 5

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}
on (rollOver) {
gotoAndPlay(8);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 6

on (rollOver) {
gotoAndPlay(9);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 7

on (rollOver) {
gotoAndPlay(10);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 8

on (rollOver) {
gotoAndPlay(9);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 9

on (rollOver) {
gotoAndPlay(11);
}
on (rollOut) {
gotoAndPlay(1);
}
	Control 10

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